













16  
992  
1008



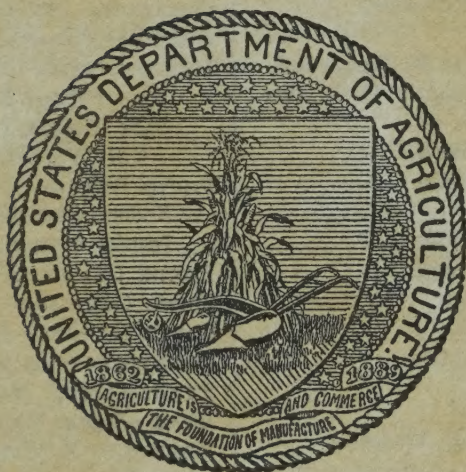
U. S. DEPARTMENT OF AGRICULTURE  
OFFICE OF EXPERIMENT STATIONS

---

# EXPERIMENT STATION RECORD

---

VOLUME 50  
JANUARY-JUNE, 1924



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1924

GOVERNMENT BOTANICAL GARDENS

LIBRARY

Section

No.



# U. S. DEPARTMENT OF AGRICULTURE.

## Scientific Bureaus.

WEATHER BUREAU—C. F. Marvin, *Chief*.  
BUREAU OF ANIMAL INDUSTRY—J. R. Mohler, *Chief*.  
BUREAU OF PLANT INDUSTRY—W. A. Taylor, *Chief*.  
FOREST SERVICE—W. B. Greeley, *Forester*.  
BUREAU OF CHEMISTRY—C. A. Browne, *Chief*.  
BUREAU OF SOILS—Milton Whitney, *Chief*.  
BUREAU OF ENTOMOLOGY—L. O. Howard, *Entomologist*.  
BUREAU OF BIOLOGICAL SURVEY—E. W. Nelson, *Chief*.  
BUREAU OF PUBLIC ROADS—T. H. MacDonald, *Chief*.  
BUREAU OF AGRICULTURAL ECONOMICS—H. C. Taylor, *Chief*.  
BUREAU OF HOME ECONOMICS—Louise Stanley, *Chief*.  
BUREAU OF DAIRYING—C. W. Larson, *Chief*.  
FIXED NITROGEN RESEARCH LABORATORY—F. G. Cottrell, *Director*.

OFFICE OF EXPERIMENT STATIONS—E. W. Allen, *Chief*.

## THE AGRICULTURAL EXPERIMENT STATIONS.

### ALABAMA—

College Station: *Auburn*; M. J. Funchess.<sup>1</sup>  
Canebrake Station: *Uniontown*; W. A. Cammack.<sup>1</sup>  
Tuskegee Station: *Tuskegee Institute*; G. W. Carver.<sup>1</sup>

ALASKA—*Sitka*: C. C. Georgeson.<sup>1</sup>

ARIZONA—*Tucson*: J. J. Thornber.<sup>1</sup>

ARKANSAS—*Fayetteville*: D. T. Gray.<sup>1</sup>

CALIFORNIA—*Berkeley*: E. D. Merrill.<sup>1</sup>

COLORADO—*Fort Collins*: C. P. Gillette.<sup>1</sup>

### CONNECTICUT—

State Station: *New Haven*; } W. L. Slate, jr.<sup>1</sup>  
Storrs Station: *Storrs*; }

DELAWARE—*Newark*: C. A. McCue.<sup>1</sup>

FLORIDA—*Gainesville*: W. Newell.<sup>1</sup>

### GEORGIA—

*Experiment*: H. P. Stuckey.<sup>1</sup>

*Tifton*; Coastal Plain Station; S. H. Starr.<sup>1</sup>

GUAM—*Island of Guam*: C. W. Edwards.<sup>1</sup>

### HAWAII—

Federal Station: *Honolulu*; J. M. Westgate.<sup>1</sup>  
Sugar Planters' Station: *Honolulu*; H. P. Agee.

IDAHO—*Moscow*: E. J. Iddings.<sup>1</sup>

ILLINOIS—*Urbana*: H. W. Mumford.<sup>1</sup>

INDIANA—*La Fayette*: G. I. Christie.<sup>1</sup>

IOWA—*Ames*: C. F. Curtiss.<sup>1</sup>

KANSAS—*Manhattan*: F. D. Farr ell.<sup>1</sup>

KENTUCKY—*Lexington*: T. P. Cooper.<sup>1</sup>

### LOUISIANA—

State Station: *Baton Rouge*; }  
Sugar Station: *Baton Rouge*; } W. R. Dodson.<sup>1</sup>  
North La. Station: *Calhoun*; }  
Rice Station: *Crowley*; }  
Fruit and Truck Station: *Hammond*; }

MAINE—*Orono*: W. J. Morse.<sup>1</sup>

MARYLAND—*College Park*: H. J. Patterson.<sup>1</sup>

MASSACHUSETTS—*Amherst*: S. B. Haskell.<sup>1</sup>

MICHIGAN—*East Lansing*: R. S. Shaw.<sup>1</sup>

MINNESOTA—*University Farm, St. Paul*: W. C. Coffey.<sup>1</sup>

MISSISSIPPI—*A. and M. College*: J. R. Ricks.<sup>1</sup>

### MISSOURI—

College Station: *Columbia*; F. B. Mumford.<sup>1</sup>  
Fruit Station: *Mountain Grove*; F. W. Faurot.<sup>1</sup>  
Poultry Station: *Mountain Grove*; T. W. Noland.<sup>1</sup>

MONTANA—*Bozeman*: F. B. Linfield.<sup>1</sup>

NEBRASKA—*Lincoln*: E. A. Burnett.<sup>1</sup>

NEVADA—*Reno*: S. B. Doten.<sup>1</sup>

NEW HAMPSHIRE—*Durham*: J. C. Kendall.<sup>1</sup>

NEW JERSEY—*New Brunswick*: J. G. Lipman.<sup>1</sup>

NEW MEXICO—*State College*: Fabian Garcia.<sup>1</sup>

### NEW YORK—

State Station: *Geneva*; } R. W. Thatcher.<sup>1</sup>  
Cornell Station: *Ithaca*; }

NORTH CAROLINA—*Raleigh*: B. W. Kilgore.<sup>1</sup>

NORTH DAKOTA—*Agriculture College*: P. F. Trowbridge.<sup>1</sup>

OHIO—*Wooster*: C. G. Williams.<sup>1</sup>

OKLAHOMA—*Stillwater*: C. T. Dowell.<sup>1</sup>

OREGON—*Corvallis*: J. T. Jardine.<sup>1</sup>

### PENNSYLVANIA—

State College: R. L. Watts.<sup>1</sup>  
State College: Institute of Animal Nutrition; E. B. Forbes.<sup>1</sup>

### PORTO RICO—

Federal Station: *Mayaguez*; D. W. May.<sup>1</sup>  
Insular Station: *Rio Piedras*; R. M. Ramos.<sup>1</sup>

RHODE ISLAND—*Kingston*: B. L. Hartwell.<sup>1</sup>

SOUTH CAROLINA—*Clemson College*: H. W. Barre.<sup>1</sup>

SOUTH DAKOTA—*Brookings*: J. W. Wilson.<sup>1</sup>

TENNESSEE—*Knoxville*: C. A. Mooers.<sup>1</sup>

TEXAS—*College Station*: B. Youngblood.<sup>1</sup>

UTAH—*Logan*: William Peterson.<sup>1</sup>

VERMONT—*Burlington*: J. L. Hills.<sup>1</sup>

### VIRGINIA—

*Blacksburg*: A. W. Drinkard, jr.<sup>1</sup>  
*Norfolk*: Truck Station; T. C. Johnson.<sup>1</sup>

VIRGIN ISLANDS—*St. Croix*: J. B. Thompson.<sup>1</sup>

### WASHINGTON—

College Station: *Pullman*; E. C. Johnson.<sup>1</sup>  
Western Station: *Puyallup*; W. A. Linklater.<sup>2</sup>

WEST VIRGINIA—*Morgantown*: H. G. Knight.<sup>1</sup>

WISCONSIN—*Madison*: H. L. Russel.<sup>1</sup>

WYOMING—*Laramie*: J. A. Hill.<sup>1</sup>

<sup>1</sup> Director.

<sup>2</sup> Superintendent.



# EXPERIMENT STATION RECORD.

Editor: H. L. KNIGHT.

## EDITORIAL DEPARTMENTS.

Agricultural Chemistry and Agrotechny—SYBIL L. SMITH.

Meteorology—W. H. BEAL.

Soils and Fertilizers—R. W. TRULLINGER.

Agricultural Botany, Bacteriology, and Plant Pathology—W. H. EVANS, Ph. D.,  
W. E. BOYD.

Genetics—W. H. EVANS, W. E. BOYD, H. M. STEECE, J. W. WELLINGTON, G.  
HAINES.

Field Crops—H. M. STEECE.

Horticulture and Forestry—J. W. WELLINGTON.

Economic Zoology and Entomology—W. A. HOOKER, D. V. M.

Foods and Human Nutrition—SYBIL L. SMITH, C. F. LANGWORTHY, Ph. D.

Animal Husbandry, Dairying, and Dairy Farming—G. HAINES.

Veterinary Medicine—W. A. HOOKER, SYBIL L. SMITH.

Rural Engineering—R. W. TRULLINGER.

Rural Economics and Sociology and Agricultural Education—LOUISE MARBUT.

Indexes—MARTHA C. GUNDLACH.

---

## CONTENTS OF VOLUME 50.

---

### EDITORIAL NOTES.

	Page
Bequest of Hatch farm for agricultural experimentation.....	1
Final report of the director of the States Relations Service.....	3
President W. M. Riggs, deceased.....	5
Change in editorial management of the <i>Record</i> .....	5
Establishment of a section of genetics.....	6
The status of experiment station research in rural economics.....	101
Federal aid to agricultural research in Great Britain, Canada, and France since the war.....	301
The stage of diminishing returns.....	401
Essentials in maintaining the volume of research product.....	405
A National Temple of Science.....	601
A biography of Senator Morrill.....	603
The Office of Experiment Stations as viewed from without.....	606
Experimental work with cotton in the British Empire.....	701

### STATION PUBLICATIONS ABSTRACTED.

#### ALABAMA STATION:

Bulletin 220.....	337
Bulletin 221.....	758
Thirty-fourth Annual Report, 1923.....	696



ALASKA STATIONS:		Page
Bulletin 4	-----	140
Bulletin 5	-----	787
Report, 1922	-----	510, 532, 539, 597
ARIZONA STATION:		
Timely Hints for Farmers, No. 144	-----	139
ARKANSAS STATION:		
Bulletin 189	-----	558
Bulletin 190	-----	850
CALIFORNIA STATION:		
Bulletin 364	-----	43
Bulletin 365	-----	342
Bulletin 366	-----	538
Bulletin 368	-----	414
Bulletin 369	-----	782
Circular 260	-----	285
Circular 261	-----	190
Circular 262	-----	741
Circular 263	-----	741
Circular 264	-----	788
Circular 265	-----	838, 845
Circular 266	-----	239
Circular 267	-----	189
Technical Paper 7	-----	409
Technical paper 8	-----	221
Technical Paper 9	-----	214
Technical Paper 10	-----	317
Technical Paper 11	-----	327
Technical Paper 12	-----	821
COLORADO STATION:		
Bulletin 287	-----	52
Bulletin 288	-----	388
Bulletin 289	-----	684
Bulletin 290	-----	645
CONNECTICUT STATE STATION:		
Bulletin 247	-----	50
Bulletin 248	-----	112, 160
Bulletin 249	-----	169
Bulletin 250	-----	626
Bulletin 251	-----	848
Bulletin 252	-----	851
Forty-sixth Annual Report, 1922	-----	696
CONNECTICUT STORRS STATION:		
Bulletin 114	-----	32
Bulletin 115	-----	334
DELAWARE STATION:		
Circular 12	-----	18
FLORIDA STATION:		
Bulletin 168	-----	660
Bulletin 169	-----	652, 654, 659



GEORGIA STATION :		Page.
Bulletin 142	-----	543
Circular 77	-----	553
HAWAII STATION :		
Bulletin 50	-----	136
HAWAIIAN SUGAR PLANTERS' STATION :		
Agricultural and Chemical Series Bulletin 47	-----	216
Entomological Series Bulletin 15	-----	756
IDAHO STATION :		
Circular 31	-----	35
ILLINOIS STATION :		
Bulletin 245	-----	75
Bulletin 245, abstract	-----	676
Bulletin 246	-----	383
Bulletin 247	-----	673
Circular 272	-----	73
Circular 273	-----	285
Circular 274	-----	357
Circular 275	-----	373
Circular 276	-----	675
Soil Report 25	-----	418
INDIANA STATION :		
Bulletin 270	-----	181
Bulletin 271	-----	178
Bulletin 272	-----	389
Bulletin 273	-----	369
Bulletin 274	-----	341
Bulletin 275	-----	374
Circular 113	-----	179
Circular 114	-----	435
IOWA STATION :		
Bulletin 216	-----	64
Bulletin 217	-----	892
Bulletin 218	-----	113
Research Bulletin 77	-----	145
Research Bulletin 78	-----	154
Research Bulletin 79	-----	172
Research Bulletin 80	-----	109
Research Bulletin 81	-----	179
Circular 87	-----	91
KANSAS STATION :		
Bulletin 230	-----	593
Technical Bulletin 11	-----	54
Technical Bulletin 12	-----	28
Circular 97	-----	65
Circular 98	-----	67
Circular 99	-----	174
Circular 100	-----	141
Circular 101	-----	539
Inspection Circular 13	-----	71
Inspection Circular 14	-----	65



## KANSAS STATION—Continued.

	Page.
Inspection Circular 16_____	20
Inspection Circular 17_____	77
Inspection Circular 18_____	20
Inspection Circular 19_____	65

## KENTUCKY STATION:

Bulletin 245_____	324
Bulletin 248_____	873

## LOUISIANA STATIONS:

Bulletin 189_____	33
-------------------	----

## MAINE STATION:

Bulletin 309_____	13, 26, 27, 95
Bulletin 310_____	37
Bulletin 311_____	74
Bulletin 312_____	350
Official Inspection 107_____	58
Official Inspection 108_____	268
Official Inspection 109_____	626

## MARYLAND STATION:

Bulletin 255_____	126
Bulletin 256_____	842
Thirty-sixth Annual Report, 1923_____	898

## MASSACHUSETTS STATION:

Bulletin 211 (popular edition)_____	577
Bulletin 215_____	72
Bulletin 216_____	168
Control Series Bulletin 23_____	383
Control Series Bulletin 24_____	774
Meteorological Bulletins 417-418, September-October, 1923_____	116
Meteorological Bulletins 419-420, November-December, 1923_____	510
Meteorological Bulletins 421-422, January-February, 1924_____	809
Thirty-fifth Annual Report, 1922, pts. 1 and 2_____	621,
	631, 642, 650, 651, 654, 655, 656, 659, 696

## MICHIGAN STATION:

Special Bulletin 119_____	289
Special Bulletin 120_____	714
Special Bulletin 122_____	242
Special Bulletin 123_____	241
Special Bulletin 124_____	278
Technical Bulletin 59_____	459
Technical Bulletin 60_____	580
Circular 61_____	475
Quarterly Bulletin, vol. 6, No. 2, November, 1923_____	411,
	419, 437, 442, 444, 445, 454, 474, 484, 496

## MINNESOTA STATION:

Bulletin 205_____	889
Technical Bulletin 13_____	156
Technical Bulletin 14_____	42
Technical Bulletin 15_____	49
Technical Bulletin 16_____	654
Thirtieth Annual Report, 1922_____	108, 120, 125, 126, 130, 132, 133, 135,
	137, 138, 140, 143, 144, 146, 148, 152, 157, 160, 163, 169, 175,
	179, 181, 191, 193, 195.



## MISSISSIPPI STATION :

	Page.
Bulletin 217.....	38
Bulletin 218.....	68
Bulletin 219.....	735
Bulletin 220.....	828
Circular 49.....	70
Circular 50.....	65
Circular 51.....	760

## MISSOURI STATION :

Bulletin 202.....	15
Bulletin 203.....	15
Bulletin 204.....	15
Bulletin 205.....	51
Bulletin 206.....	874
Bulletin 207.....	836
Bulletin 208.....	836
Bulletin 209.....	821
Research Bulletin 58.....	257
Research Bulletin 60.....	210
Research Bulletin 61.....	868
Research Bulletin 62.....	466
Circular 113.....	238
Circular 114.....	626
Circular 115.....	874
Circular 116.....	875

## MISSOURI POULTRY STATION :

Bulletin 30.....	871
Bulletin 31.....	890
Bulletin 32.....	872
Bulletin 33.....	872
Bulletin 34.....	873
Bulletin 35.....	888
Bulletin 36.....	873, 884

## MONTANA STATION :

Bulletin 158.....	209
Bulletin 159.....	209
Bulletin 160.....	893
Bulletin 161.....	871
Circular 115.....	73
Circular 116.....	535
Circular 117.....	885
Twenty-ninth Annual Report, 1922.....	116, 133, 135, 139, 143, 155, 170, 171, 176, 182, 191, 195

## NEBRASKA STATION :

Bulletin 195.....	185
Bulletin 196.....	290
Bulletin 197.....	271
Bulletin 198.....	594
Research Bulletin 24.....	335
Research Bulletin 25.....	446
Circular 21.....	79
Circular 22.....	580



NEW HAMPSHIRE STATION :	Page.
Technical Bulletin 25.....	26
NEW JERSEY STATIONS :	
Bulletin 374.....	20
Bulletin 375.....	215
Bulletin 380.....	56
Bulletin 381.....	254
Bulletin 383.....	47
Bulletin 384.....	47
Bulletin 385.....	36
Bulletin 386.....	90
Bulletin 387.....	367
Bulletin 388.....	757
Bulletin 389.....	779
Circular 153.....	90
Circular 154.....	39
Circular 156.....	455
Circular 157.....	476
Circular 159.....	791
Circular 160.....	492
Hints to Poultrymen—	
Volume 11—	
No. 12, September, 1923.....	73
Volume 12—	
No. 1, October, 1923.....	72
No. 2, November, 1923.....	383
No. 3, December, 1923.....	473
No. 4, January, 1924.....	872
No. 5, February, 1924.....	873
NEW MEXICO STATION :	
Bulletin 137.....	232
Bulletin 138.....	65
Bulletin 139.....	29
NEW YORK CORNELL STATION :	
Bulletin 420.....	57
Bulletin 421.....	89
Bulletin 422.....	492
Bulletin 423.....	294
Bulletin 424.....	230
Bulletin 425.....	487
Memoir 69.....	24
Memoir 70.....	24
Memoir 71.....	76
NEW YORK STATE STATION :	
Technical Bulletin 94.....	421, 432, 437
Technical Bulletin 95.....	408
Technical Bulletin 96.....	410
Forty-second Annual Report, 1923.....	535, 539, 546, 555, 581, 597
NORTH CAROLINA STATION :	
Technical Bulletin 22.....	274
Technical Bulletin 23.....	131
Technical Bulletin 24.....	320



## NORTH CAROLINA STATION—Continued.

## Farmer's Market Bulletin, vol. 10—

	Page.
No. 64, September, 1923.....	92
No. 65, November, 1923.....	294
No. 66, December, 1923.....	294
No. 67, January, 1924.....	793

## NORTH DAKOTA STATION:

Bulletin 167.....	67
Bulletin 168.....	80
Bulletin 169.....	33
Bulletin 170.....	837
Circular 20.....	35
Circular 21.....	35
Circular 22.....	439

## OHIO STATION:

Bulletin 364.....	238
Bulletin 365.....	294
Bulletin 366.....	256
Bulletin 367.....	270
Bulletin 368.....	448
Bulletin 369.....	468
Bulletin 370.....	572
Monthly Bulletin, vol. 8—	
No. 9-10, September-October, 1923.....	145, 156, 170, 171, 175, 195
No. 11-12, November-December, 1923---	553, 554, 573, 580, 582, 594, 598

## OREGON STATION:

Bulletin 197.....	7
Bulletin 198.....	66
Bulletin 199.....	724
Bulletin 200.....	741
Bulletin 201.....	834
Circular 50.....	53
Circular 51.....	486
Circular 52.....	590
Circular 52, Supplement.....	590
Circular 53.....	842
Circular 54.....	888
Circular 55.....	834

## PENNSYLVANIA STATION:

Bulletin 180.....	95
Bulletin 181 (Thirty-sixth Annual Report, 1923).....	411,
422, 424, 430, 432, 437, 439, 445, 453, 463, 469, 473, 474, 477, 485, 496	
Bulletin 182.....	557
Bulletin 183.....	869

## PORTO RICO DEPARTMENT OF AGRICULTURE AND LABOR STATION:

Bulletin 28 (Spanish edition).....	640
Circular 62 (Spanish edition).....	36
Circular 67 (Spanish edition).....	781
Circular 71 (Spanish edition).....	748



PORTO RICO DEPARTMENT OF AGRICULTURE AND LABOR STATION—Continued.		Page.
Circular 73 (Spanish edition) .....		738
Circular 79 (Spanish edition) .....		663
Circular 80 (Spanish edition) .....		457
Circular 82 (Spanish edition) .....		661
Circular 85 .....		357
Circular 86-87 (Spanish edition) .....		381
PORTO RICO STATION:		
Bulletin 29 (Spanish edition) .....		676
Report, 1922 .....	533, 540, 547, 550, 552, 597	
RHODE ISLAND STATION:		
Bulletin 194 .....		16
Bulletin 195 .....		35
Bulletin 196 .....		520
Annual Fertilizer Circular, 1923 .....		626
SOUTH CAROLINA STATION:		
Bulletin 216 .....		73
Bulletin 217 .....		20
Bulletin 218 .....		536
Circular 31 .....	639, 663	
Thirty-sixth Annual Report, 1923 .....	621,	
	637, 638, 642, 646, 647, 663, 672, 679, 696	
SOUTH DAKOTA STATION:		
Bulletin 203 .....		75
Bulletin 204 .....		638
TENNESSEE STATION:		
Bulletin 127 .....		31
Bulletin 128 .....		760
TEXAS STATION:		
Bulletin 305 .....		70
Bulletin 306 .....		66
Bulletin 307 .....		45
Bulletin 308 .....		759
Bulletin 309 .....		775
Bulletin 310 .....		729
Circular 30 .....		177
Circular 31 .....		220
UTAH STATION:		
Bulletin 184 .....		190
Bulletin 185 .....		119
Bulletin 186 .....		136
Bulletin 187 .....		135
Circular 48 .....		291
VERMONT STATION:		
Bulletin 230 .....		328
Bulletin 231 .....		381
Bulletin 232 .....		342
Bulletin 233 .....		338
Bulletin 234 .....		324
Bulletin 235 .....		343
Bulletin 236 .....		367



VIRGIN ISLANDS STATION :		Page.
Report, 1922	511, 533, 540, 555, 598	
VIRGINIA STATION :		
Bulletin 232	759	
VIRGINIA TRUCK STATION :		
Bulletin 43	843	
WASHINGTON COLLEGE STATION :		
Bulletin 178	276	
Popular Bulletin 124	687	
WEST VIRGINIA STATION :		
Bulletin 179	71	
Bulletin 181	73	
Bulletin 182	675	
Circular 35	867	
Biennial Report, 1921-22	195	
WESTERN WASHINGTON STATION :		
Bimonthly Bulletin, vol. 11—		
No. 4, November, 1923	113, 134, 171, 175, 184, 185, 195	
No. 5, January, 1924	520, 576, 584, 598	
WISCONSIN STATION :		
Bulletin 356	435	
Bulletin 357	649	
Bulletin 358	792	
Research Bulletin 57	279	
Research Bulletin 58	691	
WYOMING STATION :		
Bulletin 135	371	
Bulletin 136	381	

UNITED STATES DEPARTMENT OF AGRICULTURE PUBLICATIONS  
ABSTRACTED.

	Page.
Bulletin 1150, Accounting Records and Business Methods for Livestock Shipping Associations, F. Robotka	92
Bulletin 1162, The Rôle of the Genus Rhamnus in the Dissemination of Crown Rust, S. M. Dietz	43
Bulletin 1164, Segregation and Correlation of Characters in an Upland Egyptian Cotton Hybrid, T. H. Kearney	24
Bulletin 1176, Some Results of Cutting in the Sierra Forests of California, D. Dunning	241
Bulletin 1177, Irrigation District Operation and Finance, W. A. Hutchins.	186
Bulletin 1178, Bordeaux-oil Emulsion, J. R. Winston, J. J. Bowman, and W. W. Yothers	239
Bulletin 1179, Investigations of the Manufacture of Phosphoric Acid by the Volatilization Process, W. H. Waggaman, H. W. Easterwood, and T. B. Turley	521
Bulletin 1180, Field Experiments with Atmospheric Nitrogen Fertilizers, F. E. Allison, J. M. Braham, and J. E. McMurtrey, jr	621
Bulletin 1182, The Imported Pine Sawfly, W. Middleton	458



	Page.
Bulletin 1183, Milling and Baking Experiments with American Wheat Varieties, J. H. Shollenberger and J. A. Clark.....	738
Bulletin 1184, Utilization of Pima Cotton, H. H. Willis.....	435
Bulletin 1185, Flax-stem Anatomy in Relation to Retting, R. L. Davis....	335
Bulletin 1186, White Pine Blister Rust in Western Europe, W. S. Moir....	843
Bulletin 1189, Fruits in West Virginia, Kentucky, and Tennessee, G. M. Darrow.....	644
Bulletin 1190, Effect of Feeding Green Alfalfa and Green Corn on Flavor and Odor of Milk, C. J. Babcock.....	376
Bulletin 1191, Potash from Kelp: Early Development and Growth of the Giant Kelp, <i>Macrocystis pyrifera</i> , R. P. Brandt.....	424
Bulletin 1192, Improvement of Kubanka Durum Wheat by Pure Line Selection, R. W. Smith, L. R. Waldron, and J. A. Clark.....	337
Bulletin 1193, Estimation of Colloidal Material in Soils by Adsorption, P. L. Gile, H. E. Middleton, W. O. Robinson, W. H. Fry, and M. S. Anderson .....	811
Bulletin 1194, A Chemical and Structural Study of Mesquite, Carob, and Honey Locust Beans, G. P. Walton.....	501
Bulletin 1196, Food and Economic Relations of North American Grebes, A. Wetmore.....	754
Bulletin 1203, Experimental Production of Straw Gas, H. E. Roethe.....	387
Bulletin 1204, Dusting Cotton from Airplanes, B. R. Coad, E. Johnson, and G. L. McNeil.....	658
Bulletin 1205, Dusting and Spraying Peach Trees after Harvest for Control of the Plum Curculio, O. I. Snapp and C. H. Alden.....	662
Bulletin 1207, Drainage District Assessments: A Study of Present Practices in Assessing Benefits under the State Drainage Laws, G. R. Boyd and R. A. Hart.....	886
Bulletin 1208, Effect of Feeding Turnips on the Flavor and Odor of Milk, C. J. Babcock.....	377
Bulletin 1209, Effects of Selection on the Yield of a Cross Between Varieties of Corn, F. D. Richey.....	830
Bulletin 1214, Family Living in Farm Homes.—An Economic Study of 402 Farm Families in Livingston County, N. Y., E. L. Kirkpatrick, H. W. Atwater, and I. M. Bailey.....	595
Farmers' Bulletin 1311, Chrysanthemums for the Home, B. Y. Morrison....	140
Farmers' Bulletin 1339, Red Clover Culture, A. J. Pieters.....	435
Farmers' Bulletin 1340, Polish and Poulard Wheats, J. H. Martin.....	33
Farmers' Bulletin 1341, Mule Production, J. O. Williams.....	71
Farmers' Bulletin 1342, Dairy Barn Construction, K. E. Parks.....	190
Farmers' Bulletin 1343, Culture of Citrus Fruits in the Gulf States, E. D. Vosbury and T. R. Robinson.....	38
Farmers' Bulletin 1344, The Strawberry Rootworm as an Enemy of the Greenhouse Rose, C. A. Weigel and C. F. Doucette.....	55
Farmers' Bulletin 1345, Root-knot: Its Cause and Control, G. H. Godfrey....	143
Farmers' Bulletin 1346, Carpet Beetles and Their Control, E. A. Back....	56
Farmers' Bulletin 1347, Standard Varieties of Chickens.—I, The American Class, R. R. Slocum, revised by A. R. Lee.....	72
Farmers' Bulletin 1348, The Corrugation Method of Irrigation, J. C. Marr .....	84
Farmers' Bulletin 1349, Increasing the Potato Crop by Spraying, F. H. Chittenden and W. A. Orton.....	32



Farmers' Bulletin 1350, Beef-cattle Barns, E. W. Sheets and M. A. R. Kelley-----	190
Farmers' Bulletin 1351, Cabbage Diseases, L. L. Harter and L. R. Jones-----	45
Farmers' Bulletin 1352, The Tobacco Flea-beetle in the Southern Cigar-wrapper District, F. S. Chamberlin and J. N. Tenhet-----	56
Farmers' Bulletin 1353, Clothes Moths and Their Control, E. A. Back-----	53
Farmers' Bulletin 1354, The Yellow Fever Mosquito, L. O. Howard-----	53
Farmers' Bulletin 1355, Blackleg: Its Nature, Cause, and Prevention, J. R. Mohler-----	79
Farmers' Bulletin 1356, Tobacco Hornworm Insecticide: Recommendations for Use of Powdered Arsenate of Lead in Dark-tobacco District, A. C. Morgan-----	53
Farmers' Bulletin 1357, Castration of Hogs, S. S. Buckley-----	883
Farmers' Bulletin 1358, Growing Rye in the Western Half of the United States, J. H. Martin and R. W. Smith-----	639
Farmers' Bulletin 1359, Milk and Its Uses in the Home-----	58
Farmers' Bulletin 1361, Brahman (Zebu) Cattle, V. V. Parr-----	368
Farmers' Bulletin 1362, Insects Injurious to Ornamental Greenhouse Plants, C. A. Weigel and E. R. Sasscer-----	845
Farmers' Bulletin 1363, Natural and Artificial Incubation of Hens' Eggs, A. R. Lee-----	174
Farmers' Bulletin 1366, Production of Maple Sirup and Sugar, A. H. Bryan, W. F. Hubbard, and S. F. Sherwood-----	744
Farmers' Bulletin 1367, Control of Potato Tuber Diseases, M. Shapovalov and G. K. K. Link-----	840
Farmers' Bulletin 1368, Breaking and Training Colts, V. G. Stambaugh-----	372
Farmers' Bulletin 1369, Bridge Grafting, G. E. Yerkes-----	643
Farmers' Bulletin 1370, Dahlias for the Home, B. Y. Morrison-----	239
Farmers' Bulletin 1371, Diseases and Insects of Garden Vegetables, W. W. Gilbert and C. H. Popenoe-----	834
Farmers' Bulletin 1374, Care of Food in the Home-----	360
Farmers' Bulletin 1375, Game Laws for the Season 1923-24, G. A. Lawyer and F. L. Earnshaw-----	150
Farmers' Bulletin 1376, Natural and Artificial Brooding of Chickens, A. R. Lee-----	780
Farmers' Bulletin 1377, Marketing Poultry, R. R. Slocum-----	873
Farmers' Bulletin 1379, Beef Production in the Cotton Belt, A. T. Semple-----	573
Farmers' Bulletin 1380, Apple Scald and Its Control, C. Brooks, J. S. Cooley, and D. F. Fisher-----	552
Farmers' Bulletin 1383, Food Values and Body Needs Shown Graphically, E. A. Winslow-----	762
Farmers' Bulletin 1385, Buying a Farm in an Undeveloped Region, B. Henderson-----	591
Farmers' Bulletin 1387, Laws Relating to Fur Animals for the Season 1923-24, G. A. Lawyer and F. L. Earnshaw-----	252
Circular 277, Crop Tests at the Cooperative Testing Station, Sacaton, Ariz., C. J. King-----	132, 137, 146
Circular 278, The Commercial Classification of American Cotton, A. W. Palmer-----	639
Circular 279, Greasewood as a Poisonous Plant, C. D. Marsh, A. B. Clawson, and J. F. Couch-----	77
Circular 280, Kota Wheat, J. A. Clark and L. R. Waldron-----	33
Circular 281, Potato Brown Rot, F. C. Meier and G. K. K. Link-----	46



	Page.
Circular 282, The Australian Tomato Weevil Introduced in the South: A Preliminary Account, F. H. Chittenden.....	57
Circular 283, Livestock Poisoning by Cocklebur, C. D. Marsh, G. C. Roe, and A. B. Clawson.....	77
Circular 285, Status and Results of Home Demonstration Work, Northern and Western States, 1921, F. E. Ward.....	95
Circular 286, The Chayote: Its Culture and Uses, L. G. Hoover.....	139
Circular 287, The Occurrence of Diseases of Adult Bees, II, E. F. Phillips.....	158
Circular 288, The Puss Caterpillar and the Effects of Its Sting on Man, F. C. Bishopp.....	258
Circular 290, United States Grades for Rough Rice, H. J. Besley, E. G. Boerner, and W. D. Smith.....	193
Circular 291, United States Grades for Milled Rice, H. J. Besley, E. G. Boerner, and W. D. Smith.....	193
Circular 293, Commercial Control of Citrus Stem-end Rot, J. R. Winston, H. R. Fulton, and J. J. Bowman.....	149
Circular 294, The Rat Mite Attacking Man, F. C. Bishopp.....	159
Circular 295, Basic Grading Rules and Working Stresses for Structural Timbers, as Recommended by the Department of Agriculture, J. A. Newlin and R. P. A. Johnson.....	187
Circular 296, Standard Grading Specifications for Yard Lumber, as Rec- ommended by the Department of Agriculture, E. P. Ivory, D. G. White, and A. T. Upson.....	187
Circular 297, The Eelworm Disease, a Menace to Alfalfa in America, G. H. Godfrey.....	145
Circular 298, Directory of Officials and Organizations Concerned with the Protection of Birds and Game, 1923, G. A. Lawyer and F. L. Earn- shaw.....	355
Circular 299, Quarantine Procedure to Safeguard the Introduction of Citrus Plants: A System of Aseptic Plant Propagation, W. T. Swingle, T. R. Robinson, and E. May, jr.....	743
Circular 303, Hot-water Treatment of Sugar Cane for Insect Pests—A Precaution, P. A. Yoder and J. W. Ingram.....	525
Circular 305, Electrochemical Treatment of Seed Wheat, C. E. Leighty and J. W. Taylor.....	738
Circular 308, An Extension Program in Range Livestock, Dairying, and Human Nutrition for the Western States, W. A. Lloyd.....	695
Miscellaneous Circular 7, A Forest Fire Prevention Handbook for the School Children of California.....	141
Miscellaneous Circular 8, Demonstration Courses in Kiln Drying, Boxing, and Crating, Gluing of Wood, Wood Properties, and Uses.....	41
Miscellaneous Circular 9, Importation and Inspection of Tea.....	10
Miscellaneous Circular 10, Grain Futures Act, 1922.....	293
Miscellaneous Circular 11, Agricultural Cooperation: A Selected and An- notated Reading List, compiled by C. Gardner.....	92
Miscellaneous Circular 12, A Handbook for Better Feeding of Livestock, compiled by E. W. Sheets and W. Jackson.....	774
Miscellaneous Circular 13, Local Names of Migratory Game Birds, W. L. McAtee.....	150
Intermediate Credit for the Farmer.....	291
Official Record, vol. 2, No. 52, December 26, 1923.....	829
The Wheat Situation, H. C. Wallace.....	389
Warehousing Farm Products under the United States Warehouse Act.....	293



## Weather, Crops, and Markets, vol. 4—

	Page.
No. 14, October 6, 1923-----	92
No. 15, October 13, 1923-----	92
No. 16, October 20, 1923-----	92
No. 17, October 27, 1923-----	92
No. 18, November 3, 1923-----	294
No. 19, November 10, 1923-----	294
No. 20, November 17, 1923-----	259, 294
No. 21, November 24, 1923-----	294
No. 22, December 1, 1923-----	491
No. 23, December 8, 1923-----	491
No. 24, December 15, 1923-----	491
No. 25, December 22, 1923-----	491
No. 26, December 29, 1923-----	491

## Crops and Markets, vol. 1—

No. 1, January 5, 1924-----	691
No. 2, January 12, 1924-----	691
No. 3, January 19, 1924-----	691
No. 4, January 26, 1924-----	691
Supplement No. 1, January, 1924-----	692
No. 5, February 2, 1924-----	894
No. 6, February 9, 1924-----	894
No. 7, February 16, 1924-----	894
No. 8, February 23, 1924-----	894
Supplement No. 2, February, 1924-----	894

## LIBRARY:

Bibliographical Contributions No. 6, Partial List of Publications on Dairying Issued in the United States, 1920 to June, 1923, compiled by C. B. Sherfy-----	73
--	----

## BUREAU OF AGRICULTURAL ECONOMICS:

Foreign Section Report 29, The Cattle Crisis in Argentina, G. B. L. Arner-----	293
Foreign Section Report 30, Agricultural Situation in Czechoslovakia, L. G. Michael-----	296
Foreign Section Report 31, Agricultural Situation in the Republic of Hungary, L. G. Michael-----	296
Service and Regulatory Announcements No. 76, Regulations of the Secretary of Agriculture under the United States Warehouse Act of August 11, 1916, as Amended.—Revised Regulations for Cotton Warehouses, Approved May 29, 1923-----	293
Service and Regulatory Announcements No. 80, Regulations of the Secretary of Agriculture under the United States Cotton Standards Act-----	293
Service and Regulatory Announcements No. 81, Regulations of the Secretary of Agriculture under the United States Warehouse Act of August 11, 1916, as Amended.—Regulations for Peanut Warehouses-----	594

## FOREST SERVICE:

Forest Products Laboratory Technical Note 173-----	887
Forests and Forestry in the United States, H. A. Smith-----	240
Instructions for Appraising Stumpage on National Forests-----	141
Pulpwood Consumption and Wood Pulp Production, 1920, R. V. Reynolds and A. H. Pierson-----	41



## FOREST SERVICE—Continued.

Page.

Relative Humidity and Forest Fires, J. V. Hofmann and W. B. Osborne, jr.-----	743
The National Forests of the Southern Appalachians-----	39

## BUREAU OF PLANT INDUSTRY:

Inventory of Seeds and Plants Imported April 1 to June 30, 1921 (No. 67)-----	225
Inventory of Seeds and Plants Imported July 1 to September 30, 1921 (No. 68)-----	225
Inventory of Seeds and Plants Imported October 1 to December 31, 1921 (No. 69)-----	225
Inventory of Seeds and Plants Imported January 1 to March 31, 1922 (No. 70)-----	225
Inventory of Seeds and Plants Imported, April 1 to June 30, 1922 (No. 71)-----	428

## BUREAU OF SOILS:

Field Operations, 1919—	
Soil Survey in Missouri, St. Louis County-----	419
Soil Survey in New Jersey, Chatsworth Area-----	319
Field Operations, 1920—	
Soil Survey in Alabama, Geneva County-----	617
Soil Survey in Alabama, Marengo County-----	319
Soil Survey in Arkansas, Perry County-----	519
Soil Survey in California, Brawley Area-----	519
Soil Survey in Georgia, Rockdale County-----	117
Soil Survey in Iowa, Dickinson County-----	519
Soil Survey in Iowa, Dubuque County-----	520
Soil Survey in Iowa, Hardin County-----	716
Soil Survey in Iowa, Woodbury County-----	617
Soil Survey in Missouri, Lafayette County-----	617
Soil Survey in North Carolina, Buncombe County-----	618
Soil Survey in North Carolina, Tyrrell County-----	717
Soil Survey in Utah, Ashley Valley-----	814
Field Operations, 1921—	
Reconnaissance Soil Survey in Michigan, Ontonagon County---	319
Soil Survey in North Carolina, Onslow County-----	419

## WEATHER BUREAU:

Instructions for Aerological Observers, W. R. Gregg et al-----	314
Instrument Division Circular D, Appendix 2, Instructions for Wiring Meteorological Instruments, R. N. Covert-----	716
Monthly Weather Review, vol. 51—	
No. 7, July, 1923-----	114, 115
No. 8, August, 1923-----	114, 115
No. 9, September, 1923-----	415
No. 10, October, 1923-----	415, 416
No. 11, November, 1923-----	808
No. 12, December, 1923-----	807, 808
Supplement 23, 1923-----	116
Climatological Data, vol. 10—	
Nos. 7-8, July-August, 1923-----	116
Nos. 9-10, September-October, 1923-----	510



# EXPERIMENT STATION RECORD.

VOL. 50.

JANUARY, 1924.

No. 1.

A bequest of widespread interest to the experiment stations of this country is that of Miss Sallie Rores Hatch, daughter of the late Col. William H. Hatch, author of the act establishing the national system of agricultural experiment stations. Mrs. Hatch died February 6, 1923, and the daughter, the only surviving member of the family, followed her in the middle of November of the same year. The latter in her will bequeathed the home place, known as Strawberry Hill Farm, near the city of Hannibal, Missouri, to the State for use as an agricultural experiment station or such other agricultural uses as might be decided upon. The will recited that "this bequest is made in order to perpetuate the name and memory of my beloved father, William H. Hatch, who devoted the greater part of his life to the advancement of agriculture."

The farm, it is learned, consists of about 111 acres with a fine residence which Colonel Hatch built himself, located some four miles from Hannibal. It was there that he lived at the time he represented his district in Congress, from 1879 to 1895, carrying it on mainly as a country estate and stock farm. And it was to it that he retired a short time before his death, which occurred December 23, 1896.

The exact use to be made of the property under the terms of the will, it will be noted, was to be determined by the State, but the suggestion was made that it be employed for the purpose of an experiment station. This was natural, in view of Colonel Hatch's historic service, and in such a use it would seem a singularly appropriate memorial to him. It is gratifying to note that this view prevailed. In formally accepting the bequest the Governor announced the intention of employing it for that purpose, and placed it under the charge of the Missouri Experiment Station, where it will be developed in connection with the field work of the station.

It is now more than forty years since a convention of delegates from agricultural colleges met in Washington to discuss the project for the establishment of experiment stations in connection with the land-grant colleges. That convention endorsed a bill which had been introduced in the House of Representatives by Mr. C. C. Carpenter



of Iowa, carrying appropriations from the National Treasury for the purpose. Congress, however, was not quite ready to take so radical a step, involving as it did a new principle of Government in relation to these State colleges. The bill, therefore, was not put upon its passage.

Meanwhile, the number of stations established under State initiative steadily increased and public appreciation of them grew. They were seen to be indispensable to agricultural instruction and to meeting the expectations of the agricultural colleges in promoting the interests of farming. On July 8, 1885, the Commissioner of Agriculture, Mr. Norman J. Colman of Missouri, called a convention of agricultural colleges and experiment stations to meet at Washington to consider the provision of a national system of experiment stations. That convention went on record as favoring the principle and the general provisions of a measure known as the Cullen Bill, having that end in view, and emphasized the very great importance of such a step as a means for realizing the purposes of the agricultural colleges. The bill, however, failed of passage, and it was not until the following Congress that the third attempt was made to secure legislation, through a bill similar in general purport to the Cullen Bill. This was introduced by Colonel Hatch and referred to the Committee on Agriculture, of which he was chairman. A favorable report was made upon it on March 3, 1886, and nearly a year later the bill was passed by Congress, receiving the approval of President Cleveland March 2, 1887.

It will be seen, therefore, that the great step which the Hatch Act marked was the culmination of several years of earnest and persistent effort. It was important not alone in the national system of experiment stations which it established, unlike that of any other country, but perhaps equally so in the precedent it set of federal aid for the land-grant colleges. It was the first measure providing for the appropriation of money from the Federal Treasury for the use of these colleges. It was therefore epoch-making, representing a new idea, a policy to which the Government had not hitherto seemed disposed to commit itself. It thus paved the way for successive measures, the first of which came only three years later, out of which the present greatness of these colleges has developed.

This double service which Colonel Hatch rendered deserves to be remembered and the full measure of its significance appreciated. Coming twenty-five years after the Morrill Land-Grant Act and at a time when the colleges were at a low ebb in their development, the Hatch Act represented a long and very important step in advance, which on account of its radical character was not easily accomplished. Colonel Hatch stands, therefore, not alone for the act which bears his name, but for its significance at that time. His is a name



to be honored with that of Morrill whenever the benefactors of agriculture are mentioned.

And now the desire of his family to perpetuate his service by linking his former home with the system of agricultural research which his efforts established seems a fitting culmination. While such a memorial is not needed to preserve the honor and renown of his name, this legacy is a final tribute to the cause he so effectively promoted.

Because of the reorganization of certain units of the Federal Department of Agriculture last July, the report of the director of the States Relations Service for the fiscal year ended June 30, 1923, and recently made public, partakes of the nature of a valedictory. In addition to the customary review of the activities of the year, it contains a brief history by the retiring director, Doctor True, of the work carried on under his direction for thirty years. This period is, of course, nearly synchronous with the development of agricultural research in this country under Federal aid. It has also been an era of expansion for the agricultural colleges, of the widespread introduction of agricultural instruction into schools of subcollegiate grade, and of the remarkable growth and influence of agricultural extension work.

The States Relations Service, and its forerunner, the Office of Experiment Stations, have been intimately associated with the developments in all of these directions and numerous others. Doctor True's final report on these various activities is therefore a document of much more than routine character. It is an epitome of the Department's work in fostering agricultural education and research during the past generation.

Although the story is not a new one, Doctor True's account brings out many details of interest. Thus, he states that during the first five years the principal work of the Office of Experiment Stations was the organization and development of its publications. Special efforts were made by the Office to serve as a clearing house of information and to bring the work of the new stations as prominently as possible before the public. It is recalled that in the evolution of *Experiment Station Record* the abstracts of the first volume were restricted to the publications of the stations and arranged in alphabetical order by States, not because this seemed an ideal arrangement but because at that time it was deemed quite important to emphasize the fact that the stations were either distinct departments of the colleges or separate institutions having a definite organization for experimental work. Subsequently, an expansion of the *Record* became possible through the inclusion of other abstracts, first of Department publications and ultimately of results of Canadian and European work. Doctor True points out that "it is probably difficult

for present readers of *Experiment Station Record* to realize how conservative the Department was at the outset in undertaking the inclusion of abstracts of foreign publications in the *Record*. There were many doubts as to whether it had authority to do such work or whether it would be acceptable."

The development of closer relations with the individual stations through the plan of annual visitations and by the rendering of assistance in other ways is described from the point of view of one long familiar with the undertaking. The organization of the Alaska and Insular Stations under the direct supervision of the Office, the carrying on of investigations in human nutrition from 1894 to the establishment of the Bureau of Home Economics last July and of investigations in irrigation and drainage from 1893 and 1902, respectively, until their transfer in 1915 to the Office of Public Roads, the fostering of agricultural education and farmers' institutes, and the very important functions discharged for eight years by the States Relations Service in its extension work are likewise all briefly summarized.

Speaking of the work as a whole, Doctor True calls attention to the somewhat notable fact that the Office of Experiment Stations and the States Relations Service were operated under practically the same general policies for thirty-five years, and to an unusual extent for many years in the more important positions by the same personnel. To this element of continuity he is disposed to attribute much of the success attained. As he expresses it, "these Federal agencies have in a large way demonstrated what can be done through broad advisory and cooperative relations with State and local institutions and organizations, when a fairly consistent policy is pursued during a considerable number of years and loyalty to successive administrations representing different parties is combined with freedom from the objectionable features of political control."

He goes on to say that it "has been the aim of these agencies to establish standards for the organization and conduct of our institutions for research, teaching, and extension work in agriculture and home economics; to emphasize the great importance of fundamental and continued research in these fields; to aid in putting the teaching of agriculture and home economics in colleges and schools on an equal footing with other subjects taught in such institutions; and to help in developing a broad system of practical instruction for the men, women, and children on our farms which would include matters relating to agricultural production and economics, and to the material and social interests of the farm home and the rural community."

As another very vital element he states that "whatever has been accomplished in these directions has been brought about through the active and cordial interest and cooperation of many institutions and



individuals in all the States and Territories. A most encouraging feature in the development of the American system of agricultural research and education has been the growth of the cooperative spirit in the institutions and organizations devoted to this work. This has manifested itself in greater measure and in a larger number of worth-while enterprises with the progress of the years." Because of all these things, the outlook for the future he regards as very promising.

It is with deep regret that the death is recorded of Dr. W. M. Riggs, President of Clemson College, whose passing marks a great loss to the cause of education and to agriculture in the South and in the Nation. For Doctor Riggs was more than a teacher of engineering, an administrator of one of the leading institutions which sprung from the Land-Grant Act of 1862. He was a man of broad interests and sympathies which took in the whole range embraced by the colleges of agriculture and mechanic arts, and he had long concerned himself in a constructive way with the basic industry of his section. He entered actively into all measures relating to its problems and welfare. His strong, forceful character and the leadership which he attained gave him wide influence.

For years Doctor Riggs had been a national figure, notably through membership in the Executive Committee of the Association of Land-Grant Colleges. He was the appreciative, helpful friend of research and extension, as well as of academic instruction and all that pertains to the influence and the progress of these colleges. It was while in their service that the end came. Despite illness he insisted on attending a meeting of the Executive Committee in this city January 21. He took active part in its work on that day, and his colleagues had little intimation of the difficulty he was laboring under. But illness overtook him during the night and he passed away the following day.

Doctor Riggs was a native of South Carolina, received his collegiate education at Alabama Polytechnic Institute, and remained there as instructor for several years. He was called to Clemson College in 1896, rising rapidly to the head of the engineering department, and after serving a year as acting president was placed at the head of the college in 1911. From his college days he was much interested in athletics, and had been president of the intercollegiate athletic associations of his State and of the South.

The passing of this virile, many-sided man at the early age of 51 years has brought widespread sorrow and a sense of great loss.

Beginning with this issue the editorial management of *Experiment Station Record* passes into the hands of Mr. H. L. Knight. The

position is one into which he has come through long experience and by a natural process of development. For the past fifteen years he has been intimately identified with the preparation of the *Record* and since 1918 he has carried increasing responsibility as associate editor. In the latter capacity the details of supervision have been very largely in his charge.

Hence the change is largely one in title, which has been justly earned by painstaking care and scrupulous attention to accuracy of presentation, so important in the preparation of such a journal. Naturally the change in editorship will not involve any particular change in the general policy or standards which have long prevailed. As one of the leading projects carried on by the Office of Experiment Stations the *Record* will continue to receive the active interest and attention of the Chief of the Office who, as in the past, will use its editorial pages from time to time in the discussion of matters pertaining to the progress and welfare of agricultural investigation and the American experiment stations.

Another change with the new volume is the establishment of a section of Genetics. This change is in line with suggestions from many investigators and others who are interested in the development of this relatively new field of inquiry. Hitherto in the *Record's* system of classification, articles pertaining to genetics have been necessarily distributed through the sections of Agricultural Botany, Field Crops, Horticulture, Animal Production, and Dairying, and with occasional items in still other sections. For the present at least, members of the editorial staff will continue to contribute jointly to the new section along the lines handled by them in the past, and it does not seem probable that with the existing space limitations any material extension in scope will be feasible.

In the use of the new section, caution will evidently be necessary, bearing in mind the difficulty of drawing hard and fast lines of demarcation in any system of arrangement of abstracts. The more popular phases of breeding and improvement work with specific crops or animals will evidently still be most appropriately grouped as formerly with the other work pertaining to these plants or livestock. It is planned, however, to assemble in the new section the more fundamental studies of variations, cytology as the physical basis of heredity, Mendelism, quantitative and blending inheritance, linkage and crossing over, sex determination and secondary sex characters, the inheritance of acquired characters, radical crosses, selection and pure lines, and breeding methods. The growing importance of genetics as a distinctive field of research will thus be recognized, and it is hoped that the needs of geneticists will be so much more conveniently met as to warrant the departure from the previous classification.



## RECENT WORK IN AGRICULTURAL SCIENCE.

---

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

A chemical study of legumes and other forage crops of western Oregon, J. S. JONES and D. E. BULLIS (*Oregon Sta. Bul.* 197 (1923), pp. 3-24).—The purpose of this publication is to make available to the farmers of western Oregon extensive data on the chemical nature of the legume and other forage crops of the State, in order that these data may be used in the calculation of rations for livestock and of fertilizer requirements for the more important of the crops.

The materials upon which data are reported include alfalfa, red clover, alsike clover, common vetch, woolly podded vetch, hairy vetch, purple vetch, Hungarian vetch, Canada field peas, Tangier peas, white clover, sweet clover, Eureka, horse bean, wild peas, rye grass, mesquite, timothy, orchard grass, brome grass, millet, soft chess, redtop, meadow fescue, tall oat grass, cheat, meadow foxtail, Harding grass, beardless rye, *Vicia*, creeping bent, reed canary, reed fescue, *Lotus crassifolius*, sunflowers, corn, yellow clover, marshland clover, marshland grass, canary grass, sweet vernal grass, and salt grass; silages from corn, sunflowers, oats and vetch, horse beans, barley and vetch, corn and clover straw, corn and alfalfa, wheat, alfalfa, Tangier peas, sweet clover, sunflowers and pole beans, and oats and peas; and wheat, barley, oats, cheat seed, and sunflower seed. The samples from which the analyses were made represent crops of 1919 and 1921 matured for hay or silage. All samples were hand-picked and carefully handled in drying. The data reported include proximate analyses of all the materials listed for water, ash, crude protein, ether extract, crude fiber, and nitrogen-free extracts on both the air-dry and oven-dry basis; the average results of analyses of the carbohydrate fractions of the legumes; and the ash constituents, including total ash, phosphorus, calcium, magnesium, potassium, and sulphur on the air-dry and oven-dry basis of most of the legumes and a few of the grasses and grains.

From these data have also been calculated the average weight in pounds of nutrients in 100 lbs. of crop as ordinarily fed, the weight of crop in pounds required to equal in protein and the mineral elements amounts of the same substances in 100 lbs. of milk, and fertilizing materials in pounds required to replace in the soil nitrogen and other essential elements used in the production of 1 ton of air-dry legume or other forage crop.

The significance of the data is discussed from the standpoint of animal nutrition and the relation of forage crops to soil fertility.

Constituents of the waxlike coating on the surface of the apple, C. E. SANDO (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 457-468).—The author, at the Bureau of Plant Industry, U. S. D. A., has isolated from the ether extract of apple skins (mixed material from Ben Davis and Black Ben Davis varieties) the following compounds: The paraffin hydrocarbon triacontane,  $C_{30}H_{62}$ , melting at 63.5 to 64° C.; fractions of material with melting points from 70 to 79.5°

which appear to consist of hydrocarbons and alcohols, or mixtures of the two; heptacosanol,  $C_{27}H_{56}O$ , melting at 81 to 81.5° and yielding an acetate melting at 44 to 46°, and malol  $C_{30}H_{48}O_3$ , a new alcohol which crystallizes from absolute alcohol in lustrous, prismatic needles, melting at 284 to 285°. The diacetyl, monoacetyl, monomethyl, and acetylmethyl derivatives of this alcohol were also isolated and their melting points determined.

**A product of mild acid hydrolysis of wheat gliadin**, H. B. VICKERY (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 415-428, fig. 1).—In this extension of the study of the hydrolysis products of gliadin (E. S. R., 48, p. 202), a further investigation was made of the precipitate which had been observed to appear when gliadin was boiled with hydrochloric acid of concentrations between 0.2 and 4 N.

To determine whether there was any relationship between the extent of amid hydrolysis of gliadin and the appearance of this insoluble material, samples of an alcoholic solution of gliadin were subjected to hydrolysis with 2.3 N HCl, and at different periods of from 4 to 112 hours the precipitate which had formed was removed and analyzed for total and amino nitrogen, and similar analyses were made of the corresponding filtrate. The data thus obtained showed that the amount of total nitrogen in the precipitate reached a maximum when amid hydrolysis was nearly complete, and then decreased in amount. That peptid hydrolysis was taking place was shown by a steady increase in the amino nitrogen in both precipitate and filtrate. There was also an increase in the proportion of amino to total nitrogen in the precipitate, showing that the precipitate was undergoing continual change during hydrolysis. This is thought to indicate that the precipitate is not gliadin from which amid nitrogen had been removed, nor is it a markedly stable part of the gliadin molecule.

These conclusions were confirmed by a further examination of all of the products of hydrolysis of gliadin by 2 N HCl and by a comparison of the basic amino distribution of the precipitate formed during this hydrolysis with the distribution of basic amino acids in the original gliadin, and finally by a study of the rate of hydrolysis of the precipitate with 2 N HCl as compared with gliadin itself. The Van Slyke analysis for basic amino acids showed that the entire amount of lysin, approximately one-half the histidin, and about three-fourths of the arginin in the gliadin are present in the precipitate, which consequently does not represent gliadin from which amid nitrogen alone has been removed. The curves for the hydrolysis of the original gliadin and the precipitate were practically identical up to about 60 per cent of complete hydrolysis. From this point up to 80 per cent the hydrolysis of the precipitate was slower than of the original gliadin, and beyond that point there was again no appreciable difference.

"The results of this investigation do not support the old idea that hemi- and anti-groups exist in the protein molecule. Whether evidence of such could be obtained with some other protein than gliadin remains to be demonstrated. Under none of the conditions employed has it been possible to effect a differential hydrolysis of gliadin whereby the amid bindings only were broken. Although the hydrolysis of the amid bonds proceeds at a much more rapid rate than that of the peptid bonds, these two reactions have been found always to take place simultaneously."

**Some of the products obtained in the hydrolysis of white spruce wood with dilute sulphuric acid under steam pressure**, E. C. SHERRARD and G. W. BLANCO (*Indus. and Engin. Chem.*, 15 (1923), No. 6, pp. 611-616, fig. 1).—A detailed analysis is reported of the products obtained in the hydrolysis of white spruce wood with dilute sulphuric acid under steam pressure. The



optimum conditions for such an hydrolysis were found to be 115 lbs. pressure for 15 minutes, using 2.5 parts of 100 per cent sulphuric acid for 100 parts of dry wood and 2 parts of water for every unit weight of wood. The methods employed for the analysis of the hydrolysis products were essentially the same as those described by Kressmann (E. S. R., 47, p. 113). The approximate percentage composition of the sugars present in the wood liquor from the acid hydrolysis was as follows: Mannose 37.7, glucose 29.3, galactose 6.4, xylose 13.3, arabinose 5.4, and reducing volatile materials 7.9 per cent.

A comparison of the analyses by the method of Schorger (E. S. R., 37, p. 502) of white spruce wood before and after hydrolysis showed a decrease in the yield of acetic acid amounting to 91 per cent, pentosans 83, and cellulose 32 per cent, with no change in the lignin content. The wood also lost 16 per cent of its methoxy groups during hydrolysis, and the  $\alpha$ - and  $\gamma$ -cellulose were decreased and the  $\beta$ -cellulose increased.

A fundamental difference between the cellulose of wood and of cotton is shown by the fact that hydrolysis products of cotton cellulose under the same conditions contained no mannose, while mannose was found in the hydrolysis products of wood cellulose, even in those from bleached cellulose.

**Analysis of the products of hydrolysis of cyanamid by acids, A. GRAMMONT** (*Bul. Soc. Chim. France*, 4. ser., 33 (1923), No. 1, pp. 123-128).—In view of the fact that on hydrolysis calcium cyanamid is transformed into a series of derivatives of unequal fertilizing value, the author has devised a scheme of analysis to indicate the amount and nature of such transformations. This includes the determination of total nitrogen by the Kjeldahl method; ammoniacal nitrogen by the method of Ronchèse, which is based on the transformation of ammonium salts in the presence of formaldehyde into hexamethylene tetramine; urea by the method of Fosse (E. S. R., 38, p. 110), based on the action of xanthidrol on urea, forming dixanthyl urea; dicyanodiamidin by the method of Dafert and Miklomb, based on the precipitation of this substance in combination with nickel; and dicyanodiamid by difference.

The technique of the method of determining ammoniacal nitrogen is as follows: To a volume of the solution containing from 0.15 to 0.2 gm. of total nitrogen are added a few drops of a concentrated alcoholic solution of phenolphthalein and sufficient sodium hydroxid to give a permanent rose color. To this is added 10 cc. of a commercial solution of formaldehyde diluted with from 5 to 6 times its volume of water. The acid set free by the action of the formaldehyde on the ammonium salts is then neutralized with sodium hydroxid.

The determination of dicyanodiamidin requires the use of a reagent of the following composition: Nickel nitrate 10 gm., ammonium nitrate 5 gm., water 50 cc., concentrated ammonium hydroxid 15 cc., and a 10 per cent solution of sodium hydroxid 20 cc. To 10 or 15 cc. of the solution to be tested, previously neutralized with ammonium hydroxid, is added 0.1 gm. of mannite per cubic centimeter of the liquid to prevent the precipitation of nickel hydroxid by the sodium hydroxid, and then an excess of the above solution (10 or 20 cc.). To this mixture is added sufficient 10 per cent sodium hydroxid solution to form a brownish yellow color. After standing 4 hours, the yellow precipitate, which has the formula  $\text{Ni}(\text{C}_2\text{H}_4\text{ON}_4)_2 + \text{H}_2\text{O}$ , is filtered and washed with cold 2 per cent ammonium hydroxid, dried at 100° C., and weighed.

The method as described is said to be applicable to the analysis of solutions containing neither phosphoric acid nor soluble phosphates. In the case of complex fertilizers containing phosphoric acid in various forms, a preliminary precipitation of the phosphoric acid and calcium with sodium hydroxid is required.



Examples are given of analyses of several fertilizers according to this method. The distribution of nitrogen in three fertilizers, the first two of which were old and the last of recent manufacture, are in terms of total nitrogen as follows: Nitrogen of dicyanodiamid 35.3, 26.4, and 0; nitrogen of dicyanodiamidin 16.7, 26.1, and 28.8; urea nitrogen 11.9, 19.7, and 50.4; and ammoniacal nitrogen 36.1, 27.1, and 20.8 per cent, respectively.

**The march of H-ion concentration in bread doughs**, C. H. BAILEY and R. C. SHERWOOD (*Indus. and Engin. Chem.*, 15 (1923), No. 6, pp. 624-627, figs. 4).—Miscellaneous studies are reported from the Minnesota Experiment Station on the H-ion concentration of bread doughs under different conditions. Factors influencing the H-ion concentration of the dough are thought to be of significance owing to the fact that the optimum H-ion concentration for the maximum fermentation of yeast, the action of flour and malt diastase, the prevention of the action of rope-producing organisms, and the most satisfactory condition of gluten is at about  $\text{pH} = 5$ , while patent flour doughs when freshly mixed have much higher pH values, representing lower H-ion concentration. Data are reported on the rate of change in pH from the time of mixing through the fermentation period in small or laboratory doughs made with about 1 lb. of flour and fermented at  $86^{\circ}\text{F.}$  ( $30^{\circ}\text{C.}$ ); in sponge doughs prepared on a large scale, fermented about 5.5 hours, and then mixed stiff with additional flour; and in straight doughs prepared on a commercial scale and fermented for from 180 to 220 minutes.

To compare the relation of flour grade to the rate of change of H-ion concentration of the dough two samples were used, a patent flour containing 0.42 per cent ash and a clear flour containing 0.74 per cent ash. These were used for the first or laboratory doughs. Both increased in H-ion concentration during the fermentation, but the high-grade flour changed much more rapidly. On adding phosphoric acid and acid phosphates to the low-grade flour the initial acidity was increased and the acidity maintained at higher levels throughout the fermentation period. Doughs made with the use of the yeast food Arkady showed no increase in the original H-ion concentration, but increased more rapidly in H-ion concentration during fermentation than similar doughs not containing it.

In the commercial doughs the H-ion concentration increased steadily during the fermentation, but on account of the shorter fermentation period of the straight than the sponge dough the H-ion concentration did not reach as high a level in the dough or in the finished loaf as in the sponge dough. In the latter the addition of raw flour decreased the H-ion concentration.

"The exact chemical character of the acid-reacting material which accumulates in dough during fermentation has not been satisfactorily established. Much painstaking chemical research will be required to determine the quantity of various chemical compounds which contribute to the increasing concentration of hydrogen ions. It seems safe to postulate that organic acids are chief in this group of materials, and that these result, not from typical yeast activity, but rather from acid-producing bacteria usually present in the dough ingredients. That certain of these acids are volatile is suggested by the reduction of H-ion concentration during baking."

**Importation and inspection of tea** (*U. S. Dept. Agr., Misc. Circ. 9* (1923), pp. 12).—This circular contains the text of the act to prevent the importation of impure and unwholesome tea, with the regulations adopted by the U. S. Department of Agriculture and the instructions of the Treasury Department to customs officers for the enforcement of the law.

**The determination of fat in buttermilk**, P. H. TRACY and O. R. OVERMAN (*Jour. Dairy Sci.*, 6 (1923), No. 5, pp. 393-405).—This paper reports a study of



the conditions limiting the use of the Babcock test for buttermilk, and a comparison of the Babcock test, the normal butyl alcohol procedure of Mitchell<sup>1</sup> and the Roese-Gottlieb method of determining fat in buttermilk.

The special points studied in connection with the Babcock test were the amount of sulphuric acid used, length of whirling period, and speed of centrifuging. The data on these points showed that the best results are obtained with the maximum amount of acid that can be used without danger of charring the fat globules. With this amount of acid, 13.5 cc., extending the whirling period beyond the 10-10-5-minute periods and increasing the speed of the centrifuge above 900 or 1,000 r. p. m. were found not to increase the readings. As a result of these findings the following modification of the Babcock test for determining the fat in buttermilk is recommended.

If the sample contains visible granules of butterfat, it should first be strained through cheesecloth and then thoroughly mixed. A 10-gm. sample is measured with a Mojonnier pipette into a skim milk bottle, and to this is added 13.5 cc. of commercial sulphuric acid, specific gravity 1.82 to 1.83, from a burette or 14 cc. from an acid measure. After mixing well, the bottles are centrifuged at 1,000 r. p. m. for 10 minutes, after which hot water is added to fill to the base of the neck of the bottle, and the centrifuging continued for another 10 minutes. Hot water is added to the mark and the centrifuging continued for another 5 minutes. The bottles are then allowed to remain 5 minutes in a hot-water bath having a temperature of from 135 to 140° F., and the readings taken to the top of the meniscus. The readings are multiplied by 1.8 and a correction factor of 0.2 is added. This correction factor is the result of a comparison of the Babcock test as thus made with the results obtained by the Roese-Gottlieb method, the former being consistently 0.2 per cent lower.

The results obtained by the normal butyl alcohol method corresponded closely to those obtained with the Roese-Gottlieb method.

**Notes on the determination of the acetyl value**, J. R. POWELL (*Indus. and Engin. Chem.*, 15 (1923), No. 6, p. 622).—It is reported that in collaborative work in various laboratories on the determination of the acetyl values of fats and oils by the Official and by the Cook methods (E. S. R., 47, p. 311) much better agreement was obtained by the latter.

**Apparatus for the alpha-naphthol test for sucrose**, G. L. SPENCER (*Indus. and Engin. Chem.*, 15 (1923), No. 6, p. 593, figs. 2).—A convenient apparatus for the  $\alpha$ -naphthol test for detecting traces of sugar is described and illustrated.

**H-ion determination as a method of refinery control**, H. Z. E. PERKINS (*Indus. and Engin. Chem.*, 15 (1923), No. 6, pp. 623, 624).—This is a preliminary report on the establishment of refining limits of H-ion concentration in factory control in sugar refining. The points at which control of acidity and alkalinity is exercised are in the washing plant in which all raw sugar is washed and the first separation made between high and low products; the treating or blowup tanks in which the washed sugar and the sirup washings are treated with phosphoric acid, lime, and diatomaceous earth preparatory to clarification; and in the sweet water reduction or the washings from the filter bags and presses.

In the washing plant the condition of safety for the dissolved washed sugar or first liquor is within pH limits of 6.4 to 6.8. This can best be tested with indicators while the secondary products are too dark to give satisfactory colors, but are better electrolytes and can be tested easily with the potentiometer. The average pH values for the sirup in the treating tanks at vari-

<sup>1</sup> Chicago Dairy Prod., 28 (1921), No. 27, pp. 16-19.



ous stages are green wash sirup 3.6 to 4, after defecation and clarification 5 to 5.6, and after boneblack filtration 5.6 to 6. The sweet water concentrate should have pH values of from 4.8 to 5 after concentration, from 5 to 5.8 after liming and defecation, and from 5.4 to 6 after boneblack filtration.

**A preliminary study of a plunger type of jelly strength tester,** S. E. SHEPPARD and S. S. SWEET (*Indus. and Engin. Chem.*, 15 (1923), No. 6, pp. 571-576, figs. 15).—A plunger type of jelly strength tester is described and illustrated, and a study is reported of the effect upon the accuracy of determinations of jelly strength with such an instrument, of the shape of the plunger, depth of jelly, and ratio of diameters of vessel and plunger.

Plungers with a round base were found to be unsatisfactory because the area of contact varies with the load. The frustrum of a cone with a larger base applied to the jelly surface proved a satisfactory shape. For any diameter of plunger the depth of jelly should be great enough to prevent an interfering reaction from the base. Under these conditions, with jellies up to 8 per cent concentration, the results obtained with the plunger tester and with the torsion instrument previously described (*E. S. R.*, 44, p. 613) were comparable.

**Acetone, butanol, and ethanol in gas from the butyric fermentation of corn,** A. L. DAVIS (*Indus. and Engin. Chem.*, 15 (1923), No. 6, pp. 631, 632).—For complete recovery of acetone, butyl alcohol, and ethyl alcohol formed in the butyric fermentation of corn, the passage of the gases formed during fermentation through activated carbon or cresol, and the subsequent recovery by distillation of the liquid absorbed have proved satisfactory methods. It is stated that the gases produced during the butyric fermentation of corn contained from 0.105 to 0.125 gal. of the mixed solvents per 1,000 cu. ft. of gas, and that cresol containing from 95 to 97 per cent tar acids is capable of recovering 90 per cent of the solvents present in the case of this concentration.

## METEOROLOGY.

**World weather,** H. H. CLAYTON (*New York: Macmillan Co.*, 1923, pp. XX+393, pls. 15, figs. 265).—This book stresses the larger aspects of world meteorology and the relation of solar phenomena thereto. It elaborates especially the author's well-known views on such subjects as the relation of weather changes to sun-spot cycles and weather forecasting, based on solar radiation measurements as developed and used by the author in the Argentine weather service. An attempt is made "to explain a part of the vast stock of knowledge accumulating about the weather, especially those newer researches which indicate that the time is near at hand when weather changes can be anticipated so far in advance as to save much of the loss and distress which now follows in the wake of the unexpected adverse conditions." Various illustrations of the economic advantages of such forecasts are cited. The contents of the book are an introduction and chapters on the forces controlling weather changes; the daily period in the weather; the yearly period in the weather; temperature and the weather; pressure and the weather; wind and the weather; moisture, clouds, and rainfall; cyclones and anticyclones, or storms and sunshine; sky colors and visible signs of the sky and air; the sun and the weather; physics of the air in relation to solar and terrestrial radiation; periodicity in the weather and in solar phenomena; forecasting the weather; and the meteorology of the sun. Appendixes are included as follows: Formulas for computing pressure, gradients, and winds; the method of correlation; and harmonic analysis.

**The local forecasting of weather,** DE MONTESSUS DE BALLORE (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 26, pp. 1913-1915; *abs. in Rev. Sci. [Paris]*,



61 (1923), No. 13, p. 414).—The author concludes that direction of the wind is the best element upon which to base local weather forecasts. Other elements in decreasing order of importance are height of the barometer, force of the wind, variation in pressure, and cloudiness.

The possibility of predicting the yield of crops on the basis of meteorological records, K. KNOCH (*Naturwissenschaften*, 11 (1923), No. 37, pp. 769-776).—This is a critical review of the development of agricultural meteorology, especially in the United States, but in other countries as well, with numerous references to the literature of the subject, and with discussion in detail of the various lines of study which have been undertaken or proposed, including particularly correlation, critical period, and forecast studies, and warnings of frost and other untoward conditions.

The truth about drought, S. F. MORSE (*Facts About Sugar*, 17 (1923), No. 14, p. 320).—This article refers briefly to studies by the U. S. Weather Bureau of the relation of deforestation to drought, and to investigations by others on the relation of weather cycles to rainfall. Soil conditions which mitigate the effects of drought are also briefly discussed.

The meteorological service of Brazil, S. FERRAZ (*Met. Ztschr. [Brunswick]*, 40 (1923), No. 8, pp. 242-244).—The new service organized in 1921 is briefly described, and its activities along the lines of climatology, weather forecasting, agricultural meteorology, rainfall and flood service, and aerology are reviewed.

With regard to agricultural meteorology, it is stated that eight stations of the Brounov type, dealing with wheat, rice, rye, cotton, sugar cane, and grapes, have been established and are in operation. The work of these stations is of the same character as those formerly in operation in Russia, modified somewhat in accordance with the plan put into operation by Azzi in Italy. No worth-while conclusions can now be reached by the statistical method because of the lack of accurate data. A 10-day bulletin, giving the conditions of the most important crops, pasture lands, streams, and roads, as affected by the weather, is published and widely distributed. Short monthly reports are published in the papers. Report forms for phenological observations as made in Canada and England are distributed to voluntary observers and are collected and compiled for different places in the country every six months.

Meteorological observations [at the University of Maine, Orono], J. S. STEVENS (*Maine Sta. Bul.* 309 (1922), pp. 96-98).—A tabular summary is given of monthly and annual temperature, precipitation, cloudiness, and wind during 1922. The mean temperature for the year was 41.21° F., as compared with 43.09° for 54 years; the precipitation was 37.18 in., as compared with a 54-year mean of 39.36 in. The snowfall was 79.25 in., the number of clear days 139.

The rainfall of Chile, M. JEFFERSON (*Amer. Geogr. Soc., Research Ser.* No. 7 (1921), pp. 32, pls. 2, figs. 7).—It is shown that the north of Chile is practically rainless. The far south is "a vast morass." "The main home of the Chileans lies between these extremes"—largely in the interior valleys. The rains come from the Pacific and are profoundly modified by the topography. This is shown in a rainfall map compiled by the author from records of 167 stations up to and including 1918. This map differs widely from any heretofore published, all of which the author states have quite misrepresented the distribution of rainfall in Chile except as regards the general dryness of the north and the wetness of the south. The misleading character of isohyets based upon insufficient observational data is discussed at some length.

**Rainfall map of Africa**, J. B. KINCER (In *The Vegetation and Soils of Africa. Amer. Geogr. Soc., Research Ser. No. 13* (1923), pp. 245, 246, pl. 1).—This map, compiled mainly for the purpose of correlating rainfall with the soils and vegetation of Africa, shows isohyets for, as a rule, every 10 in. of mean annual rainfall, based on the records of 757 stations. In its broad features it closely resembles those of Hann (E. S. R., 23, p. 418; 25, p. 507), Fraunberger (E. S. R., 18, p. 312), Knox (E. S. R., 26, p. 715), and others.

### SOILS—FERTILIZERS.

**Investigations with Sikorsky's sedimentation cylinder**, E. G. DOERELL (*Internatl. Mitt. Bodenk.*, 12 (1922), No. 3-6, pp. 186-191, fig. 1).—A description of the Sikorsky sedimentation apparatus for separating sand and clay is given, together with the results of tests made to compare the efficiency of this apparatus with others. It is concluded to be scientifically inexact and of value only for obtaining quick, approximate results.

**Some physical constants of soil**, C. R. HARLER (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, 1921, No. 4, pp. 214-233).—The results of some of the physical and mechanical studies of soils carried out in connection with the soil survey of the tea districts of northeast India are briefly reviewed. These relate mainly to soil grading, tilth, moisture values, and so-called soil condition, or the state of aggregation of the particles of the soil. Tabular data from some of these studies are included.

**The Dooars soil survey**, P. H. CARPENTER (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, 1921, No. 4, pp. 195-208, figs. 3).—This survey deals with the mechanical, physical, and chemical properties of the soils of a subtropical area along the northern boundary of Bengal, bounded on the west by Nepal and on the east by Assam. It is a long narrow strip of land, with the direction of the slope at right angles to its longitudinal axis. Several rivers cross the area and carry large quantities of matter in suspension, from which the present soils have originated. This deposit of soil is of a sandy or silty nature.

Another entirely different type of soil in the west center of the area is known as the Red Bank, a high plateau soil. It is of a clayey nature and is evidently of very great age. Mechanical analyses of the Red Bank soil indicate that one of its characteristics is the small quantity of fine sand.

All of the old alluvium soils are said to contain a plentiful supply of potash, phosphoric acid, nitrogen, and organic matter, and the percentages of lime and magnesia are also said to be high, although not sufficient to prevent a marked acid reaction in the soils. It is noted that the acidity increases the longer the soil is under cultivation, and at the same time the efficiency of the natural drainage of these soils decreases.

**Hardpan in the Apulian soils and its origin**, A. DE DOMINICIS (*Ann. R. Scuola Super. Agr. Portici*, 2. ser., 16 (1920), Art. 2. pp. 18; abs. in *Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 13 (1922), No. 2. pp. 164, 165).—In a second contribution to the subject (E. S. R., 48, p. 814) an extension of the studies of Apulian hardpans to districts of Apulia other than the Bari district is reported. The same experimental methods were employed as in the first study.

The results brought out the general significance of the data previously obtained, and indicated that hardpan is not a phenomenon confined to rocky massive subsoils. It is concluded that the formation of all superficial hardpans in general and of the Apulian hardpans in particular always depends upon the same set of conditions, always occurs in the same manner, and is



due to the coagulation which takes place when colloidal matter occurring as hydrosols in the circulating soil water comes into contact with bivalent electrolytes, such as calcium carbonate, which are dissolved in the capillary water. The composition and proportions of the pan thus formed depend upon the capacity of the resulting mass for the absorption of calcium carbonate.

The conditions necessary for the formation of hardpan are, therefore, (1) a dry climate and a subsoil consisting of a rocky mass rich in calcium carbonate and possessing a very active capillary system, (2) calcium carbonate dissolved in the capillary water and the presence of sufficient colloidal matter in the form of reversible hydrogels and hydrosols in the circulating water, and (3) the opportunity for hardpan formation at the point of contact of the soil and the subsoil.

**Salt soils (alum soils) of the humid climate of Finland, B. AARNIO** (*Internatl. Mitt. Bodenk.*, 12 (1922), No. 3-6, pp. 180-185).—The results of a brief chemical study of certain alkali soils occurring in humid portions of Finland are briefly reported.

The analyses showed a rather high content of alum in the surface soils. The occurrence of high salt concentrations in these soils is attributed to a too high ground water level, resulting in a capillary rise of soluble salts to the surface soil. Lowering the ground water level by drainage, followed by leaching and cultivation, apparently reclaimed these soils. A study of the capillary rise of salt solutions in sand soils showed that aluminum salts can rise by capillarity only a very short distance. It is concluded that the main factors in the occurrence of such soils are the soil type and the ground water level, and that climate is not an important factor.

**Soil experiments on the gravelly Ozark upland, M. F. MILLER and F. L. DULEY** (*Missouri Sta. Bul.* 202 (1923), pp. 22, figs. 12).—The results of seven years' experiments on the fertility requirements and crop adaptations of the Clarksville gravelly loam soils of the Ozark upland are reported.

The results demonstrated the value of treatments with available phosphoric acid, especially when accompanied with manure, and the importance of crop rotations including legumes and the development of permanent pastures. Potash fertilizers did not give profitable returns on this soil, and it was found necessary to supplement manure, even in liberal applications, with phosphates.

**Soil experiments on the brown silt loam of the Border Ozark Region, M. F. MILLER and F. L. DULEY** (*Missouri Sta. Bul.* 203 (1923), pp. 24, figs. 6).—Experiments begun in 1912 on the fertility requirements and crop adaptations of the brown-colored Union silt loam soils of the Border Ozark Region of Missouri are reported in this bulletin.

The results showed that the use of available phosphoric acid is indispensable to profitable crop production on these soils, acid phosphate and steamed bone meal being usually the best forms to use. The value of ground limestone and barnyard manure on these soils, as well as the importance of the adoption of systems of rotation including legume crops, was also demonstrated.

**Controlling soil moisture for vegetable crops in Missouri, J. T. ROSA** (*Missouri Sta. Bul.* 204 (1923), pp. 8, figs. 3).—Studies on the effects of irrigation and mulching of soils on the yields of tomatoes, peppers, eggplants, and cucumbers are reported.

The increased yields obtained from irrigation are considered to justify the use of overhead irrigation for the intensive cultivation of valuable crops in Missouri. Irrigation apparently did not affect the proportion of early maturing fruits, but susceptibility to disease increased on the irrigated plats. Straw mulching gave smaller increases, which appeared the latter part of the season,

and during the first two weeks of harvest the tomato yields were greater from the unmulched plats. The effects of straw mulching are attributed to reduction of soil temperature and decrease in fluctuations of the soil moisture content.

[Soil reclamation studies on the] Dacca Experimental Farm, T. Roy (*Bengal Agr. Jour.*, 2 (1922), No. 3, pp. 111-118).—Studies on the reclamation of acid red soil in the Madhupur Jungle are reported.

This soil belongs to the formation known as the old alluvium. It is a red clay and sets hard, like cement. It was found to be in poor physical, chemical, and biological condition, acid, and especially deficient in phosphoric acid and lime. The first application of lime and bone to any plat which had not already been treated with wood ashes in large quantities resulted in phenomenal yields of paddy, jute, maize, and other crops. The poor capillary condition of the soil was found to be due more to the presence of colloidal iron oxid than to a deficiency in organic matter, and the better physical condition following the application of lime and bone was due, to some extent at least, to their action on the colloidal iron. While green manures, especially after the application of lime and bone, increased the fertility of the land and improved its physical texture, they were found not to pay.

**Adsorption phenomena in soil: Method for determination of the exchangeable or adsorptively combined bases in soil and their importance for the soil processes**, D. J. HISSINK (*Internatl. Mitt. Bodenk.*, 12 (1922), No. 3-6, pp. 81-172).—This is a detailed account in German of studies which have been previously noted from the Dutch (*E. S. R.*, 45, p. 323).

**Adsorption and replacement of plant food in colloidal oxids of iron and aluminum**, D. C. LICHTENWALNER, A. L. FLENNER, and N. E. GORDON (*Soil Sci.*, 15 (1923), No. 3, pp. 157-165, figs. 2).—In a contribution from the University of Maryland studies on the adsorption of plant nutrients from solutions of nutrient salts by ferric and aluminum hydrogels are reported.

These studies showed that nitrates were only slightly adsorbed, while the sulphates, and particularly the phosphates, were largely adsorbed. The order of adsorption of the cations was calcium, magnesium, and potassium, while the order of adsorption of the anions was phosphate, sulphate, and nitrate. The time required for equilibrium to be established was a function of the amount of shaking and the rate of adsorption. The adsorption was specific, and with solutions of the same salt its amount increased with an increase of concentration.

The adsorption of a metallic ion depended upon its accompanying negative ion. The converse was true, but to a much less degree. The nitrates and sulphates adsorbed by the hydrogels could be entirely leached out by water, while only about one-third of the adsorbed phosphates could be removed by leaching. Only the water-leachable material followed the adsorption equilibrium law.

**"Active" aluminum as a factor detrimental to crop production in many acid soils**, P. S. BURGESS and F. R. PEMBER (*Rhode Island Sta. Bul.* 194 (1923), pp. IV+40, figs. 6).—Studies on the toxic properties of active aluminum in acid soils are reported, together with a method for the quantitative determination of active aluminum in soils.

Preliminary pot experiments showed that the growth-inhibiting action of certain acid soils could be partly overcome by large applications of either soluble phosphates or lime and largely overcome by both. The specific detrimental factor was not correlated with excessive H-ion concentration, for where large acid phosphate applications were given this was slightly increased temporarily, while immediate yields were usually greatly enhanced.



Further pot experiments, in the course of which H-ion concentrations and amounts of active aluminum in differently treated soils were periodically determined, showed that treatment with lime without acid phosphate, while greatly reducing the amounts of active aluminum in the soils, did not result in the largest crops. Acid phosphate treatment without lime usually produced large initial crops irrespective of accompanying high acidity and usually without reducing the amounts of active aluminum in the soils to the levels effected by the high lime treatments. Combinations of lime and acid phosphates were better than either alone and are recommended for the correction of acid soil conditions.

Heavy applications of soluble phosphates without lime to acid soils exerted a decidedly depressing initial effect upon aluminum solubility, which, however, was transitory. After about three months re-solution of aluminum commenced and progressively increased. Small amounts of the aluminum of certain acid soils were found to be extracted readily with water. In the same soil type a fairly close correlation existed between the growth of sensitive crop plants, the amounts of active aluminum present in the soil, and the H-ion concentration of the soil.

Both greenhouse and field observations indicated that large amounts of decomposing organic matter were efficient in counteracting the deleterious effects of active aluminum upon sensitive crops. A tentative classification of the comparative resistances of a number of crop plants to soil acidity and active aluminum is proposed, based upon field studies, wherein pH and active aluminum were compared with plant growth.

Chemical analyses of several of the crops from the pot experiments to determine aluminum and phosphorus contents showed that in all cases heavy lime additions greatly reduced the percentages of aluminum absorbed by plants while they slightly increased the phosphorus percentages, although poor yields of crops of low resistance were usually obtained. Plants which received large amounts of acid phosphate grew well, although they contained approximately the same percentages of aluminum as the checks.

The results are taken to indicate that acid phosphate renders soluble aluminum salts nontoxic, largely by counteracting their injurious effects within the plants. Plants grown in naturally neutral or slightly alkaline soils contained as high percentages of aluminum as those grown in acid soils, but the former contained from three to five times as much phosphorus.

**Influence of time of year on nitrate formation in soil, F. LÖHNIS** (*Centbl. Bakt. [etc.]*, 2. Abt., 58 (1923), No. 9-12, pp. 207-211).—The author summarizes the results of work by himself and others bearing on the subject, and draws the conclusion that in certain cases nitrate formation in soils shows variations at different times of the year which are not caused by variations in temperature or moisture content. Fall and spring maxima and winter and summer minima have been most often observed. It is considered out of the question that these variations are caused by physical factors, but that biological factors probably exert an essential influence.

**Relation between the content of nutrient material in soil and the assimilation of nutrients by potatoes, J. KÖNIG, J. HASENBÄUMER, and J. SCHÄFFERS** (*Landw. Jahrb.*, 58 (1923), No. 1, pp. 55-85).—Experiments on the determination of the availability of plant nutrients in soils are reported.

The results showed that extraction with a 1 per cent citric acid solution gives as good indications of the availability of the potash and phosphoric acid in soil as steaming. It made no marked difference whether a 0.5, 1, or 2 per cent solution of citric acid was used. The 1 per cent solution is con-

sidered to be the best, but the use of an amount corresponding at least to the lime content of the soil was necessary.

Earlier indications that the amount of potash assimilated by plants is approximately the same as that extracted from the soil by steaming were not borne out by these experiments. Where more than 8 mg. of soluble potash were extracted from 100 gm. of soil by steaming, potash fertilization had no effect upon crops.

It is concluded that the ratio of potash, nitrogen, and phosphoric acid suitable for potatoes can be used as a measure for the fertilizer requirements of soil. For local conditions in Germany this ratio has been found to be about 100:75:25. This ratio can be determined only on the basis of a good average crop.

**Relation between the content of nutritive constituents of soil and the assimilation of nutrients by oats, and a study of the influence of plants and fertilizers on soil acids, J. KÖNIG, J. HASENBÄUMER, and E. KRÖGER (*Landw. Jahrb.*, 58 (1923), No. 1, pp. 87-124, figs. 3).**—In the first part of this paper studies of the fertility requirements of soil, as indicated by the analysis of oats plants and the solution of soil nutrients by steaming and treatment with 1 per cent citric acid, are reported.

The results showed that the amount of potash obtained by steaming a sample of soil 20 cm. (7.87 in.) deep for 5 hours under 5 atmospheres pressure corresponded closely with the amount assimilated by oats. The amount of phosphoric acid obtained by this method was much greater than that absorbed by oats plants, the latter absorbing only about 0.15 as much.

A 1 per cent citric acid solution removed much more phosphoric acid from soil than the steaming treatment. It is concluded that the use of 1 per cent citric acid will indicate the difference between soils treated with small amounts of potash and phosphoric acid and unfertilized soils, and the relation of these to the amounts of nutrients assimilated by plants. In this connection it was found that of the potash dissolved from soil by 1 per cent citric acid about 0.2 was assimilated by plants and of the phosphoric acid 0.1. On this basis, it is further concluded that the 1 per cent citric acid solution should indicate the potash or phosphoric acid requirements of a soil for the production of a maximum crop. The details of procedure in this method of determining fertility requirements of soils are outlined.

In the second part, studies of the influence of crops and fertilizers on soil reaction are reported. The results indicated that the amounts of commercial fertilizers used in practice do exercise an influence on soil reaction which can be detected by an H-ion concentration determination after a reasonable time. Crops were also found to influence soil reaction, generally causing an increase in acidity, the magnitude of which depended upon the kind of crop. When an excess of lime was added it combined with the acids excreted by plants, and no change in soil reaction could be detected by a determination of the H-ion concentration.

It is concluded that acid soils should be fertilized with alkaline or neutral salts, but that such treatment on very acid soil should be preceded by liming or marling. Alkaline soils should be fertilized with acid or physiologically acid reacting salts.

**Fertilizers for Delaware crops and soils, C. A. MCCUE and G. L. SCHUSTER (*Delaware Sta. Circ.* 12 (1923), pp. 12, figs. 10).**—Practical information on the rational use of fertilizers and fertilizer materials, with particular reference to the requirements of the soils and crops of Delaware, is presented in this circular.



**Efficiencies of phosphatic fertilizers as affected by liming and by the length of time the phosphates remained in Porto Rican soils,** P. L. GILE and J. O. CARRERO (*Jour. Agr. Research* [U. S.], 25 (1923), No. 4, pp. 171-194, fig. 1).—Experiments conducted by the Porto Rico Experiment Station to determine the relative efficiencies of acid phosphate, rock phosphate, bone meal, basic slag, and double superphosphate in nine different soils in which millet was grown are reported. The influence of liming and of the length of time the phosphates remained in the soil on their relative efficiencies was also determined.

The relative efficiencies of all the phosphates varied widely in the different soils, especially those of bone meal and rock phosphate. None varied directly with the lime requirement of the soil, although rock phosphate and bone meal were generally most effective in the soils with high lime requirements.

Applications of lime, equivalent to the lime requirement of the soil determined by the Veitch method, decreased the efficiencies of acid phosphates, basic slag, and double superphosphate in some soils and increased them slightly in others. In two soils liming had little influence on bone meal, but in the seven other soils it markedly decreased its efficiency. A considerable further decrease in the efficiency of bone meal occurred when the quantity of lime applied was increased beyond the amount indicated by the lime requirement of the soil. The efficiency of rock phosphate was decreased by liming to an approximately constant value in all soils—about 3 per cent that of acid phosphate. Practically no difference in efficiency was observed regardless of whether the lime was applied to the soil 6 weeks before or immediately before the phosphate was applied.

When the five phosphates remained in the soil for a period of six weeks their efficiencies diminished very appreciably in all soils whether limed or not. This diminution in efficiency was greater for acid phosphate, basic slag, and double superphosphate than for bone meal or rock phosphate. Acid phosphate continued to lose in efficiency the longer it remained in the soil, although the losses were exceedingly small after the first 20 to 30 days.

It is stated that as a rule only from 10 to 20 per cent of the phosphoric acid applied is recovered in the crop. This is taken to indicate that such losses in efficiency are of general occurrence, and that they are due to the action of soil constituents in rendering the phosphoric acid unavailable to plants.

**Availability of potassium in orthoclase for plant nutrition,** D. E. HALEY (*Soil Sci.*, 15 (1923), No. 3, pp. 167-180).—Studies conducted at the Pennsylvania Experiment Station on the rate of availability of the potassium of orthoclase when supplied in finely divided form to buckwheat grown in quartz sand cultures are reported.

Twenty-five-gram portions of the orthoclase pulverized to pass through a 200-mesh sieve, were found when subjected to the solvent action of distilled water, to yield soluble potassium at the rate of 282.2 parts per million at the point of equilibrium between solute and solvent. This orthoclase was added in 25, 50, and 75-gm. portions and intimately mixed with 2,750 gm. of sand.

The 50-gm. portions of orthoclase supplied potassium at a sufficiently rapid rate to satisfy the requirements of 7 per cent larger yields of dry matter than were produced by the complete nutrient solution. With 75 gm. of orthoclase the increase of dry weight of plants was 21 per cent. Plants grown in pots in which the potassium was supplied as orthoclase contained only 30, 60, and 85 per cent as much potassium for the 25, 50, and 75-gm. portions of orthoclase, respectively, as was contained in the plants grown in the complete nutrient solution. The total amount of potassium available from the orthoclase was in no case as large as that in the nutrient solution, but the physiological balance of

the solution in the sand culture was apparently favorable to a more economical use of the element.

Calcium carbonate and sulphate tended to increase the quantity of available potassium and to aid in the production of a larger amount of dry matter as long as a lack of potassium was the limiting factor in plant growth. Under these conditions sodium chlorid also tended to increase the weights of dry matter, but on the whole reduced the amount of available potassium. The effect of sodium sulphate was negative in this respect. Dextrose and starch tended to reduce the weight of dry matter and potassium absorption. The addition of calcium carbonate to these materials did not materially affect the results with dextrose, but resulted in an increase in yield and in potassium absorption with starch.

**Biochemical oxidation of sulphur and its significance to agriculture,** J. S. JOFFE (*New Jersey Stas. Bul.* 374 (1922), pp. 5-91, figs. 4).—This bulletin represents an attempt to bring together the available information concerning the important relations which sulphur bears to agriculture. Part 1 summarizes the work of others bearing on the subject, while part 2 summarizes the studies conducted by the author at the stations, the main problems discussed being sulphur transformations in soils, microorganisms concerned in the oxidation of sulphur, production of acid phosphate by the Lipman process, reclamation of alkali soils, and other minor subjects. Reports on most of these studies have been noted in the *Record* from time to time and from various sources. A bibliography of 241 titles is appended.

**Fertilizer control in 1920,** C. O. SWANSON and W. L. LATSHAW (*Kansas Sta. Insp. Circ.* 16 (1922), pp. 31, fig. 1).—This circular contains actual analyses and guaranties of 154 samples of fertilizers and fertilizer materials collected for inspection in Kansas during 1920, together with data on the sale and prices of fertilizers in the State and lists of brands of fertilizers registered and of dealers in fertilizers during the year.

**Fertilizer control in 1921,** W. L. LATSHAW (*Kansas Sta. Insp. Circ.* 18 (1922), pp. 20).—This circular contains data corresponding to those noted above, including actual analyses and guaranties of 48 samples of fertilizers and fertilizer materials collected for inspection in Kansas during 1921.

**Analyses of commercial fertilizers,** R. N. BRACKETT and H. M. STACKHOUSE (*South Carolina Sta. Bul.* 217 (1923), pp. 58).—The results of actual analyses and guaranties of 1,181 samples of fertilizers and fertilizer materials collected for inspection in South Carolina during the season 1922-23 are reported and discussed.

The results showed that where the guaranteed water-soluble material was below 50 per cent the greatest discrepancies appeared between the found and the guaranteed water-soluble ammonia equivalent of nitrogen. It is also noted that the shortage of organic ammoniates still persists.

## AGRICULTURAL BOTANY.

**Temperature effects in plant metabolism,** W. E. TOTTINGHAM (*Jour. Agr. Research* [U. S.], 25 (1923), No. 1, pp. 13-30, pls. 4, figs. 2).—A report is given of experiments with red clover grown in greenhouses at different temperature ranges and of buckwheat grown in climatic chambers in which a high and a low range of temperatures were maintained. Under the conditions of the experiment red clover was found to contain about 4 per cent more of polysaccharids in the tops of the plants grown at the lower temperature (averaging 15° C.) than in the other case (20.6°). The crude protein content of the plants was least at the lower temperature, but not in proportion to the difference of



polysaccharids. Buckwheat grown in soil cultures in the temperature chambers contained 5.8 per cent more starch in the seeds and 5.2 per cent more polysaccharids in the stems at the lower ( $17.5^{\circ}$ ) than at the higher temperature ( $22.8^{\circ}$ ). The nitrogen contents of the stems and leaves varied inversely as the polysaccharid contents, but not proportionately so. When grown in sand cultures buckwheat contained 4.8 per cent more polysaccharids in the stems at the lower temperature ( $20.1^{\circ}$ ) than at the higher one ( $25.7^{\circ}$ ). Plants grown at the higher temperature produced no seeds of normal appearance.

It is believed that atmospheric temperature modifies the percentage of polysaccharids in the tissues of plants under the conditions of the experiment.

**A method of application to plants of the biochemical procedure for glucose research**, M. BRIDEL and R. ARNOLD (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 23, pp. 1434-1436).—The application of the biochemical research and characteristic procedure said to have been effected in comparatively simple cases in 1920 by Bourquelot and Bridel (*E. S. R.*, 44, p. 713) has been utilized by the present authors in research with matters as complex as certain plants, and such work is herein briefly detailed.

**Research methods in geobotany**, E. RÜBEL (*Geobotanische Untersuchungsmethoden*. Berlin: Borntraeger Bros., 1922, pp. XII+290, pl. 1, figs. 69).—Systematic exposition is given of the problems, factors, and methods involved in a study of geobotany, including necessary instruments and their employment.

**The general presence of manganese throughout the plant kingdom**, G. BERTRAND and M. ROSENBLATT (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 5, pp. 333-336).—It is concluded on the basis of data here tabulated for various plants that the presence of manganese in plants and parts of plants is practically universal.

**The availability of mineral plant food: A modification of the present hypothesis**, N. M. COMBER (*Jour. Agr. Sci. [England]*, 12 (1922), No. 4, pp. 363-369).—The assumption that plants feed in the soil just as they feed in water-culture solution is held to be unjustified and contrary to the facts. In modification of the usual hypothesis two possibilities are discussed, namely, the absorption of colloids by the plant, and the union of the root hair with soil and other mineral particles (so that the plant and the soil form one system) and the dissolution of the particle by the organic matter of the root hair so attached.

**Acid production by *Rhizopus tritici* in decaying sweet potatoes**, H. A. EDSON (*Jour. Agr. Research [U. S.]*, 25 (1923), No. 1, pp. 9-12).—In a previous publication (*E. S. R.*, 45, p. 750) attention was called to a greater loss of carbohydrates in sweet potatoes infected by *R. tritici* than could be accounted for by the carbon dioxid evolution and fungus growth, and it was suggested that acids and alcohol were formed during the processes of decay.

The present author has continued the investigation with a view to identifying the acids produced. It was found that the fermentation produced in sweet potatoes decaying through the action of *R. tritici* is of a familiar alcohol-acetic acid type, in which, in addition to alcohol and acetic acid, much smaller amounts of formic, butyric, lactic, and succinic acids were found, as well as acetone and an unidentified aldehyde, and that ammonia is among the nitrogenous decomposition products.

**H-ion changes induced by species of *Rhizopus* and by *Botrytis cinerea***, J. L. WEIMER and L. L. HARTEB (*Jour. Agr. Research [U. S.]*, 25 (1923), No. 3, pp. 155-164).—In a previous publication (*E. S. R.*, 49, p. 729) attention was called to the fact that when a modified Czapek nutrient solution with glucose as a source of carbon was employed for cultures of *R. tritici*, the enzym was

not produced, but a certain amount of maceration of the tissue of raw sweet potato disks resulted which was found to be caused by the acid formed by the organism. In order to determine the effect of the organism on the H-ion concentration, studies were carried on on the growth of 11 different species of *Rhizopus*, in which their effect on the acidity of Czapek nutrient solution was determined. It was found that *R. nigricans* and *R. microsporus* made the solution less acid, while all the other species made it more acid.

The expressed juice from sweet potatoes decayed by *R. tritici* was found to be more acid than that from potatoes decayed by *R. nigricans*. Raw sweet potato disks suspended in the juice of sweet potatoes decayed by *R. tritici* were macerated in a shorter time than those immersed in juice from potatoes decayed with *R. nigricans*. However, if the juice in both cases was brought to the same H-ion concentration, the disks were macerated in the same length of time. Light was found to exercise very little influence on the production of pectinase.

Changes in the H-ion concentration of the substrate, induced by *B. cinerea*, were studied for several different media, and the results show that H-ion concentration of some substrates was increased, while that of others was decreased. *B. cinerea*, although not normally a sweet potato storage-rot organism, is said to produce a small amount of pectinase capable of dissolving the middle lamellae of raw sweet potato disks when grown in artificial cultures.

**Influence of salt on the development of *Sterigmatocystis nigra*,** M. MOLLIARD (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 18, pp. 1188-1120).—Sodium chlorid at concentrations ranging to 10 per cent lowers the activity of *S. nigra*. At the higher percentages it conduces indirectly to sterility and determines the accumulation of nitric acid.

**Oxygen-supplying power of the soil as indicated by color changes in alkaline pyrogallol solution,** L. M. HUTCHINS and B. E. LIVINGSTON (*Jour. Agr. Research [U. S.]*, 25 (1923), No. 3, pp. 133-140).—A method is described that is considered very promising for determining the oxygen-supplying power of soils at different depths and under different conditions of soil moisture and of packing.

**The physiological rôle of anthocyanin,** S. JONESCO (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 21, pp. 1311-1313).—In wheat and buckwheat plants which had developed anthocyanin pigments in light and were afterwards kept in darkness both anthocyanin and flavone glucosids decreased progressively and in considerable amount with the period of darkness. Reducing sugars under the same circumstances increased in wheat and decreased in buckwheat. Nonreducing sugars and starch both decreased in darkness. Cellulose increased in both plants in darkness, the plant at the same time continuing to grow and form new tissues.

**The mitochondrial origin of anthocyanic pigments in fruits,** J. POLITIS (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 17, pp. 1061-1063).—Anthocyanic pigments have been observed in *Vitis vinifera*, *Solanum melongena*, and *Convallaria japonica* as elaborated in numerous mitochondria, also in a cyanoplast, which is briefly described.

**The defensive rôle of the chondriome against parasitism,** J. POLITIS (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 8, pp. 421-423).—The parasite excitation in the plants may cause a state of reaction in mitochondria, which are able to serve as centers of elaboration for the greater part of the products of secretion of the cell. Certain of these products (tannins) form in very large quantity and probably exert a defensive action against invasion of the organisms by parasitism. The reaction in the mitochondria varies in



different plants and in the same plant according to the degree of development and the nature of the parasite.

**Microsomes and lipid formations in plant cells**, A. GUILLIERMOND (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 26, pp. 1676-1678).—As a result of observations during the study of intracellular structures, in particular certain ones designated by Dangeard (*E. S. R.*, 45, p. 30) as a special system, the spherome, the present author concludes that microsomes are simply products of cellular metabolism. Apparently they are constituted for the most part of lipoids, sometimes in connection with neutral fats. The terms microsome and spherome are considered as inappropriate and properly replaceable by the term lipid granulations.

**The action of pressure on plant cells**, E. COUVREUR and P. CHOSSON (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 26, pp. 1678, 1679).—Observations are outlined on the effects of pressures in triturating cells of *Solanum dulcamara* and *Helleborus foetidus* as compared with those on certain animal materials. It is stated that the expressible juices of certain plants are not equally proteolytic, and that this matter is to be further studied.

**Modifications of plant roots and stems by mechanical action**, E. BLOCH (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 24, pp. 1524-1526, figs. 6).—In pursuance of a line of work previously indicated (*E. S. R.*, 43, p. 732), the author has obtained effects of modification which are indicated with different plants which have attained their complete normal development, i. e., have flowered and fruited.

**A cause of sterility in rice flowers**, R. K. BHIDE (*Agr. Jour. India*, 17 (1922), No. 6, pp. 584-586).—Noting the frequent occurrence of empty glumes in certain rice varieties grown in western India, some of which are very briefly discussed, the author expresses the opinion that failure to form a complete ear of grain is not always due to unfavorable environment but sometimes to pollen malformation or deficiency; and that this defect is hereditary.

**Botanical determination of foreign beans**, N. T. GIUNG (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 23, pp. 1436-1438).—Different species of *Phaseolus* are described in connection with characters available as systematic determinants.

## GENETICS.

**Variegation and its inheritance in *Chlorophytum elatum* and *C. comosum***, E. J. COLLINS (*Jour. Genetics*, 12 (1922), No. 1, pp. 1-17, pls. 8, figs. 3).—The genetical research of which this paper gives some account originated with the observation made in 1912 that the seedlings springing up around a large clump of *C. elatum albo-marginatum* were wholly green and did not reproduce the albo-marginate character of the presumed parent. The author has been interested in the research since 1915 and is responsible for the views herein expressed.

“The number of seedlings raised of which records have been made is 2,389, and the summarized tables show in some detail how these seedlings have been bred. Of this total, 1,814 seedlings were green, 445 albino, and 130 or 5.4 per cent were recorded as throwing some form of variegation. In no instance was the orderly type of variegation characteristic of the original forms directly reproduced.

“Variegation in the seedlings must originate in the first instance by some peculiar action which brings about a somatic segregation of the two opposite characters, and the disorderly distribution to the leaves must depend upon the sequence and mode of the subsequent meristematic segregations. Though

not at present referable to any cause, it is clear that this pair of allelomorphs, for green and colorless plastids, are especially liable to such somatic segregation, which has brought about the long series of variegated plants. . . .

"In general the results may be interpreted in the sense that no matter how the pollinations are made the progeny result as follows: (a) Seed carried on wholly green flowering stems produces green seedlings; (b) seed carried on wholly white flowering stems produces seedlings devoid of chlorophyll and which subsequently die; (c) seed borne on striped flowering stems gives green seedlings, white seedlings, and seedlings showing variegation of irregular pattern; (d) seed gathered from finely striped flowering stems produces a much larger proportion of these irregularly variegated seedlings, while, from those flowering stems showing broad bands of green and white, seed can be isolated which will give wholly green or wholly white seedlings.

"A fact of further interest has been revealed by the later growth of the disorderly variegated seedling crowns and the subsequent production of new basal crowns. Where the variegation is of the finely divided order the crowns quite frequently run out wholly green or wholly white. . . . The conditions which lead to the production of disorderly variegation appear to be unstable and temporary and it is presumed that conditions of stability are regained by further segregations in the apical meristems and consequent reorganization of the distribution of albinotic and chlorophyllous cells."

**The inheritance of blotch leaf in maize**, R. A. EMERSON (*New York Cornell Sta. Mem.* 70 (1923), pp. 3-16, pls. 3).—Blotch leaf of maize is said to be characterized by the presence, principally on the leaves, of blotches of a yellowish color, a considerable part of the tissues of which usually dies. A study has been made of this phenomenon, and it is thought to be due to a weakness of certain plants, and the intensity of blotching was found to be increased by strong sunlight and correspondingly reduced by shade. The character is believed to have originated as a somatic mutation in a single plant and is inherited as a recessive, or nearly recessive, character.

**The morphology of the double kernel in *Zea mays polysperma***, M. E. STRATTON (*New York Cornell Sta. Mem.* 69 (1923), pp. 3-18, figs. 8).—The results are given of a study of a variety of corn recently described (E. S. R., 45, p. 32). In this variety the spikelets are said to have two functional flowers, the development of which results in a pair of separate kernels arranged back to back and connate seeds or semiconnate seeds. With the exception of minor differences the two flowers develop in a manner exactly comparable to that of the one functional flower of the normal spikelet. The development of two flowers in the spikelet is considered a reversion toward a more primitive many-flowered condition.

**The hybrids of barley**, L. BLARINGHEM (*Ann. Sci. Agron. Franç. et Étrangère*, 6. ser., 38 (1921), No. 4, pp. 177-230, pls. 2).—The characters of elementary barley species and of the barley kernel are considered, together with an account of the author's technique and the results of crosses between pure varieties.

Since the factor pair *Aa* concerned with the hairs of rachilla (*A* rigid, *a* cottony) had a Mendelian behavior in 29 crosses between varieties pertaining to 3 different species, it should be considered as independent of other characters. The pair *Bb*, relative to the presence or absence of barbs on the lateral nerves of the lemma, manifested its independence only within *Hordeum distichon nutans*.

**Segregation and correlation of characters in an upland-Egyptian cotton hybrid**, T. H. KEARNEY (*U. S. Dept. Agr. Bul.* 1164 (1923), pp. 58, pls. 21,



*figs. 41).*—A genetic study of the kind and degree of segregation in an upland-Egyptian hybrid, Holdon×Pima, was made to obtain statistical data as to the nature and behavior of the variants to be expected in fields of either type when exposed to natural cross-pollination by the other. Holdon and Pima differ in respect to a great number of characters, many of which distinguish the two types of cotton in general. Earlier studies with Pima have been noted (E. S. R., 45, p. 341; 49, p. 226). The ancestry of the hybrid is reviewed, and the characters distinguishing the parent varieties and the characters of the  $F_1$  hybrid are indicated and defined. Statistical constants of the parental and of the  $F_1$  and  $F_2$  hybrid populations are tabulated, and the frequency distributions of the  $F_2$  of the hybrid are shown graphically. Other phases discussed include Mendelian segregation in the Holdon-Pima hybrid, data of this hybrid compared with other evidence of Mendelian segregation in cotton hybrids, evidence from  $F_3$  of segregation in this hybrid in characters not giving definite Mendelian ratios in  $F_2$ , extraparental characters in  $F_2$  of the hybrid, sterility in  $F_2$  and  $F_3$  of the hybrid, and correlation of characters in  $F_2$  of the hybrid.

Although the data on correlation indicate relative freedom of recombination, the chances seem to be heavily against the isolation and fixation of a productive type of cotton, combining the most desirable characters of both parents, from the segregation products of so wide a cross as that between upland and Egyptian. Accidental cross-pollination between these cottons evidently can not but greatly impair both the uniformity and the fertility of either type. These conclusions are considered to be in line with the practical experience of cotton breeders. In roguing seed-increase fields of upland or of Egyptian cotton, the absence of characters definitely associated with the other type should not be regarded as proof that cross-pollination has not occurred. It is advisable to remove all plants which show peculiar or abnormal characters on the suspicion that they are products of accidental hybridization.

**Genetic analysis, schemes of cooperation and multiple allelomorphs of *Linum usitatissimum*, T. TAMMES** (*Jour. Genetics*, 12 (1922), No. 1, pp. 19-46, *figs. 22*).—Having discussed in previous papers (E. S. R., 36, p. 434) the genetic constitution of *L. usitatissimum* for the color and some other characters of the flower and the seed, and the interaction of the hereditary factors of genes, determined by means of crossing, the work has been continued and has resulted in further analyzing that part of the genotypes especially relating to the characters above mentioned.

For *L. usitatissimum* eight factors have now been determined as influencing the color, shape, and breadth of the petal, and the color of the anther and the seed coat. These factors cooperate in various ways to bring about the characters mentioned. Some of these factors influence several characters together, and their action in producing those various characters is quite different.

The 64 genetically different forms with colored flowers show 40 different phaenotypes; the 192 white colored genotypes show 6 different phaenotypes. With the different phaenotypes occur 6 one-sided and 1 common correlation. Probably some of these correlations may still be broken up. The cooperation of the various factors in producing the characters may be represented in a simple synoptic way by what are called genetic schemes of cooperation.

The common blue-flowering flax possesses all of the eight factors. All other forms mentioned in this paper are loss mutants. They are distinguished by the lack of one or two factors of the common blue-flowering type.

Three series of multiple allelomorphs, each consisting of four, have been determined. For the flower color the genetic differences between some forms are so slight that they are scarcely perceptible. The fluctuating variability of



the flower color, on the other hand, is very great; the range of variation of one single form comprises the phenotypes of many others.

**Inheritance of size and conformation in sheep,** E. G. RITZMAN (*New Hampshire Sta. Tech. Bul.* 25 (1923), pp. 36, figs. 4).—This is a report of a study of the inheritance of size and conformation in crosses of Rambouillet and Southdown sheep. The first part of the work deals with the hereditary behavior of external body measurements. In addition to the data that were previously reported (*E. S. R.*, 44, p. 71), more  $F_2$ s (a total of 41 mature ewes) have been measured, and the dimensions of the parts are given with the probable error of the mean and the coefficient of variability for each. The percentage of the variates falling in different groups for each measurement were determined as an aid to noting segregation and variability of the  $F_1$  and  $F_2$  populations. "In mean measurements the  $F_2$  are shorter in trunk, greater in body depth and width, and they are longer legged. However, in measurements of stature the  $F_2$  show a consistently greater variability, than  $F_1$ , foreleg length, neck length, head length, and hind leg circumference forming the exception. Of these, neck length may be discarded as unreliable, while hind leg circumference is a measure of fleshiness rather than of stature."

As regards measurements which were of markedly different size in the two parents, the crosses usually gave intermediate results and showed less variation in the  $F_1$ , with increasing variation in the  $F_2$ , and a more uniform distribution from the size of the small parent to the size of the larger one. Where the mean of both parents was similar the variability of the  $F_1$ s was reduced, but in the  $F_2$  generation more variability may be shown than by either the  $F_1$ s or the purebred parents. The decrease in variability of the  $F_1$ s, with the resulting increase in variability in the  $F_2$ s, is an indication of segregation, but there was practically no evidence of dominance of the characters of one parent except in head length. Similar conclusions were drawn from a study of the ratios between the measurements of the different parts of the body.

In making a study of internal characters, 3 Southdown, 3 Rambouillet, 7  $F_1$  Southdown $\times$ Rambouillet hybrids, 2  $F_2$  Shropshire $\times$ Rambouillet hybrids, 1 Hampshire-Rambouillet, and 3 animals of mixed breeding were slaughtered and their carcasses cut transversely between the fifth and sixth rib and photographed. Measurements were taken of the transections from a lantern slide projection of the photograph. From the studies of the cross sections the Southdowns were found to be shorter in rib, wider at the base of the thoracic cavity, and to have longer spinous processes. The hybrids showed similar length of rib, but resembled the Rambouillets in the width of the thoracic cavity at the base and in the length of the spinous processes. There was little difference in the spring of rib between the sheep of the different types. The length of the spinous processes of the vertebrae is apparently closely correlated with the thickness of flesh.

**Sterility in wheat hybrids.—II, Chromosome behavior in partially sterile hybrids,** K. SAX (*Genetics*, 7 (1922), No. 6, pp. 513–552, pls. 3; *abs. in Maine Sta. Bul.* 309 (1922), pp. 93–95).—In continuation of investigations on sterility in wheat hybrids (*E. S. R.*, 48, p. 433), studies were made of a number of crosses of wheat groups characterized by different numbers of chromosomes (*E. S. R.*, 46, p. 430).

In the  $F_1$  of crosses between the groups having 7 and 14 gametic chromosomes but very few normal mature pollen grains were formed. In crosses between groups having 14 and 21 chromosomes the tetrads and one-nucleate pollen grains appear to be normal, but later about 20 per cent of them appear to be imperfect and a larger number are believed to be nonfunctional.



The sterility in the hybrids is accounted for on a hypothesis involving (1) the numerical or unbalanced relations of the chromosomes resulting from the irregular meiotic divisions, and (2) the specific interrelations of the parental chromosomes. This hypothesis, it is believed, will explain the differences in sterility of the various species hybrids, the partial association of the original parental characters in the  $F_1$  segregates, the absence of varieties or species with intermediate chromosome numbers, and the difficulty in obtaining homozygous segregates combining the desirable characters of the parental species in partially sterile wheat hybrids.

In all cases the  $F_1$  plants are said to have been unusually vigorous, and sterility is considered not due to poor vegetative development but caused by the formation of nonfunctional gametes. Sterility in the  $F_2$  segregates may be greater than in the  $F_1$  individuals, due not to greater gametic sterility in itself but to a combination of weak somatic development and gametic sterility.

**Sterility in wheat hybrids.**—III, **Endosperm development and  $F_2$  sterility**, K. SAX (*Genetics*, 7 (1922), No. 6, pp. 553–558; *abs. in Maine Sta. Bul.* 309 (1922), pp. 95, 96).—The author claims that crosses between strains of wheat which differ in chromosome number result in small, wrinkled grain and more or less sterility in the  $F_1$  generation. It is believed that since poorly developed  $F_1$  endosperms are associated with sterility and unusual vegetative vigor of the  $F_1$  plant, a high degree of correlation would be expected between  $F_2$  endosperm development and sterility and vegetative development of  $F_2$  plants. From data obtained from a cross of Kubanka  $\times$  Bluestem, it is found that there is little or no correlation between  $F_2$  endosperm development and  $F_2$  sterility or vegetative development.

**The inheritance of glume-length in a wheat cross**, F. L. ENGLEADOW (*Jour. Genetics*, 13 (1923), No. 1, pp. 79–100).—Further studies (E. S. R., 44, p. 832) of pure lines of Polish and Kubanka wheat and their hybrids appeared to demonstrate the purity of the parental stocks and of an  $F_2$  Polish extract. Consideration of the interparental factorial difference in regard to glume-length and the permanency of the shifted values led to the suggestion that the unifactorial difference of the parents is substantiated, and that a stable condition is reached in  $F_2$  and persists at least to  $F_3$ . Straw-inheritance in the Polish  $\times$  Kubanka cross seemed to possess no feature of special interest and none bearing upon “shift” in mean glume-length. Measurements of the kernels borne by  $F_2$  and  $F_3$  intermediates gave evidence of only one length-type. It is felt that the existence of shift as a phenomenon distinct from multiple-factor action still remains a matter of uncertainty.

**The position and number of spikelets on the progeny of speltoid heterozygotes**, B. KAJANUS (*Hereditas*, 4 (1923), No. 1–2, pp. 10–16).—Studies of the internode length of spikes (rachis) and the number of spikelets on progenies from speltoid heterozygotes are reported. Fifteen progenies belonged to the  $F_4$  of a cross between *Triticum vulgare* types, Weibulls Iduna  $\times$  Sammet, and 5 were the  $F_2$  of *T. vulgare*  $\times$  *T. speltoides*, the latter being derived from a cross between *T. vulgare* and *T. turgidum*.

The internode length of the rachis was apparently greater and the number of spikelets smaller with the heterozygotes than with the vulgare plants. The homozygotic speltoids further exceeded the heterozygotes in respect to internode length and had fewer spikelets. The increase of internode length and the decrease of number of spikelets in the series vulgare-heterozygotes-speltoides were shown clearly by  $F_2$  of *T. vulgare*  $\times$  *T. speltoides*, where the heterozygotes were almost exactly intermediate in both respects.

## FIELD CROPS.

**Experimental activity in crop production and moor culture and its organization in Denmark and Norway**, H. WITTE (*Svenska Mosskulturför. Tidskr.*, 37 (1923), No. 2, pp. 93-122, figs. 18).—A description is given of the more important lines of work of the principal experiment stations in Denmark and Norway visited in 1922 on an official mission of study. Special attention is given to the work conducted in the moorland regions of the two countries, and the organization and operation of the different experiment stations visited are briefly noted.

**Report of the [Danish] State Plant Culture Committee for the fiscal year 1922-23** (*Beret. Statens Planteavl. [Denmark]*, 1922-23, pp. 111).—This report gives a brief history of the Danish experiment stations; outlines their present organization, including a list of the principal officials and workers; reviews briefly the activities of each station in 1922, together with the meteorological and other conditions influencing their work; and presents in detail the budget of the various stations for the fiscal year 1922-23, as well as a summary of the budget for the fiscal year 1923-24. A list of the publications issued by the stations, including 162 titles, is given, and articles prepared by the stations but published in agricultural and other journals are also noted by title.

**Practical results of the plant breeding station at Gross Enzersdorf**, E. TSCHERMAK (*Arb. Deut. Landw. Gesell. Österr.*, No. 10 (1922), pp. 19).—Brief agronomic descriptions are presented of the improved hybrids and pure lines of rye, wheat, and spring and winter barley developed by the author.

**[Report of field crops work in Montserrat, 1920-21]**, F. WATTS (*West Indies Imp. Dept. Agr., Montserrat Agr. Dept. Rpt.*, 1920-21, pp. 3-10, 15-17, 20-25).—The progress of variety tests (E. S. R., 46, p. 131) with Sea Island cotton, sugar cane, yams, sweet potatoes, and beans for green manure is reported, with notes on breeding work and the depression of lint length with cotton and the status of the cotton industry. A more detailed account of the sugar experiments has been given by Collens (E. S. R., 48, p. 834).

**[Report of field crops work in the United Provinces of Agra and Oudh, India, 1920-21]**, G. CLARKE, A. E. PABE, L. C. SHARMA, W. N. HARVEY, ET AL. (*United Provs. Agra and Oudh. Agr. Stas. West. Circle Rpt. 1921*, pp. 1-9, 27-31, 34-38, 57-80, 83, 84; *Cent. Circle Rpt. 1921*, pp. 1-17, 24-30, 34-41, 47-51, 54-57, 60-62; *East. Circle Rpt. 1921*, pp. 2-10+2-5+7-9; *Northeast. Circle Ann. Rpt. 1921*, pp. 2-4, 7, 8).—The continuation (E. S. R., 46, p. 227) of variety, cultural, and fertilizer tests with cotton, wheat, sugar cane, and various experiments with different forage, cereal, and fiber crops is reported.

**[Report of field crops work at the Alibag Agricultural Station, Kolaba District, India, 1916-1920]**, V. G. GOKHALE, G. B. PANDIT, and K. B. GUJAR (*Bombay Dept. Agr., Alibag Agr. Sta. Rpt. 1917-1920*, pp. 9-85, 88-105, 106-125, figs. 2).—Supplementing earlier work (E. S. R., 40, p. 523), detailed reports are given of cultural, fertilizer, varietal, and seed selection tests with rice, comparisons of native grasses, rotations, trials of emergency crops after rice failure, and miscellaneous experiments with various field crops.

**Relative water requirement of corn and sorghums**, E. C. MILLER (*Kansas Sta. Tech. Bul. 12* (1923), pp. 3-34, figs. 5).—Experiments were conducted at Garden City and Manhattan, Kans., to determine the relative water requirement of some of the more common varieties of corn and sorghum when grown under similar environmental conditions, and to find if a definite relationship exists between the water requirements of these plants and their drought



resistance. Preliminary studies at Garden City have been noted (E. S. R., 35, pp. 437, 529).

Considering the average water requirement of Kansas Orange sorgo (257) as 1, the average water requirements of the plants grown at Manhattan in 1918, 1919, and 1920 would be as follows: Red Amber sorgo 1.02, White milo 1.03, Dawn kafir 1.08, Blackhull kafir 1.08, Dwarf milo 1.1, Acme Dwarf broom-corn 1.1, feterita 1.19, Sherrod White Dent corn 1.21, Pride of Saline corn 1.26, Freed White Dent corn 1.31, Freed sorgo 1.33, Kansas Sunflower corn 1.35, Sudan grass 1.37, and Reid Yellow Dent corn 1.4. The relative values of the water requirements of the plants grown at Garden City in 1916 and 1917, considering that of Blackhull kafir (305) as 1, were as follows: Dwarf milo 1.01, Dawn kafir 1.02, feterita 1.18, Sherrod White Dent corn 1.21, Pride of Saline corn 1.31, and Sudan grass 1.34.

Little or no relationship is indicated between the water requirement of plants and their ability to produce a yield of grain in agricultural practice under conditions of limited and uncertain rainfall.

**Experiments on the manuring of beans and red clover**, A. W. OLDERSHAW (*Jour. Roy. Agr. Soc. England*, 83 (1922), pp. 110-131, figs. 2).—Extended rotation experiments at Saxmundham in East Suffolk on a soil with sufficient lime showed that farmyard manure gives excellent results as a fertilizer for beans and should be applied wherever possible. Where only a moderate application of manure is available, the addition of a phosphatic fertilizer, such as superphosphates or basic slag, is considered desirable. Fertilizer experiments with red clover in similar rotations gave evidence that farmyard manure, whether applied directly to the clover or some years previously, has a very beneficial effect upon the crop. The fact that an active nitrogenous manure like sodium nitrate had little or no beneficial effect upon the clover points to the conclusion that it is not so much the nitrogen contained in the farmyard manure as the other ingredients which are of benefit to the clover.

**Agave varieties**, E. PEREDO (*Rev. Agr. [Mex.]*, 7 (1922), No. 5, pp. 267, 268).—Comparative analyses of four important Mexican agaves are tabulated and discussed. The average fiber yield amounted in henequen to 13.2 per cent, maguey cenizo 5.57, maguey pitzometl 8.7, and maguey cimarron 7.66 per cent.

**Alfalfa**, G. R. QUESENBERRY (*New Mexico Sta. Bul.* 139 (1923), pp. 19, figs. 7).—A practical discussion of the environmental and cultural requirements of alfalfa and of the management of the crop under irrigation. In preliminary tests at the station Peruvian averaged 6.54 tons per acre in five cuttings, native common 4.92, Grimm 5.09, and Turkestan 4.43 tons. Fertilizer experiments (E. S. R., 47, p. 433) and studies of soil moisture movement in relation to the growth of alfalfa (E. S. R., 43, p. 738) have been described earlier.

**Alfalfa culture in Argentina**, C. D. GIROLA (*Mus. Agr. [Soc. Rural Argentina]*, Pub. 23 (1922), pp. 16, figs. 6).—Information concerning the growing of alfalfa in Argentina is presented, together with the details of an alfalfa seed production contest in 1921 and observations on typical weeds as noted by Von Petery (E. S. R., 45, p. 824) and the effects of climate, insects, and diseases on the crop. A total of about 20,674,500 acres was reported in 1919-20, with the most extensive production in Buenos Aires, Cordoba, Santa Fe, Pampa Central, San Luis, and Entre Rios.

**The origin of smooth awned barley**, N. I. VAVILOV (*Trudy Prinkl. Bot. i Selekt. (Bul. Appl. Bot. and Plant Breeding)*, 12 (1921), No. 1, pp. 53-128, pls. 2).—The F<sub>2</sub> generation of certain hybrids of rough awned barley varieties included plants with smooth awns, and this was confirmed by repeating the

crosses. Among other peculiarities noted were 2-rowed and 6-rowed barleys with naked kernels, as well as 6-rowed smooth barley. All sorts of gradations were observed between dentition and smoothness. Further studies indicated that the awns of rough awned barley differed strikingly from one another in both cross section and dentition.

The smooth awned forms appeared in the hybrid generation of crosses between rough awned barleys only when the parental forms were clearly distinguished by the character of awns and teeth. The individuality of the parental race is also considered of prime importance. Observation on the  $F_3$  and comparisons of the morphology of the races studied suggest at least five or six hereditary dental factors determining the form, character, and arrangement of the teeth on the awns. Large numbers of individuals are required for the production of smooth awned plants, probably increasing with the number of factors involved.

In southern Russia and Asia Minor, where smooth awned barleys occur most frequently, the factors contributing to their production comprise meteorological conditions favoring open blooming and consequent natural hybridization, the mixture of varieties and types used for seed, and particularly the presence in those regions of corresponding races of rough awned barley, which when crossed produce plants with smooth awns. The races of *Hordeum* which produced smooth awned plants in the hybrid generation indicated are also found in these regions, several being indigenous to the Caucasus.

The studies, which were conducted at the Moscow Agricultural Institute, are reported in both Russian and French.

**Two Mediterranean clovers new to the United States**, S. F. BLAKE (*Science*, 57 (1923), No. 1484, p. 665).—*Trifolium hirtum*, a native of the Mediterranean region and northern Africa, was collected in Virginia in May, 1922. *T. angustifolium*, from the Mediterranean region of Europe, Asia Minor, and Africa, as well as the Azores and Canary Islands, was collected in Alabama in June or July, 1922. Brief botanical descriptions are given.

**Growth of fruiting parts in cotton plants**, R. D. MARTIN, W. W. BALLARD, and D. M. SIMPSON (*Jour. Agr. Research [U. S.]*, 25 (1923), No. 4, pp. 195–208, pls. 2).—Data were recorded on the order and rate of appearance and growth of floral buds, the sequence of flowers, and the growth of bolls on Lone Star, Acala, Durango, and Pima Egyptian cotton at Sacaton, Ariz., in 1921 and 1922; Lone Star near Greenville, Tex., in 1922; and Meade and Sea Island near Charleston, S. C., in 1922.

Successive fruiting branches were produced about 3 days apart, and successive squares on the fruiting branch appeared about 6 days apart, without significant differences among the varieties. The interval between the appearance of successive squares on the fruiting branches increased progressively along the branch. The intervals between squares produced at the same dates are about equal regardless of the positions of the squares on the branches. The square period, or interval between appearance of a square and its date of flowering, showed consistent differences among varieties, being for Sea Island about 33 days, Pima 30, Meade 28, and for Lone Star, Acala, and Durango 23 days.

Floral buds of Lone Star cotton at Greenville, Tex., grew at a nearly constant daily rate until within about 3 days of flowering, when an increased rate was noted. The floral buds were evidently not large enough to develop boll weevil larvae successfully until about 15 days before blooming, or about 10 days after the squares appear. The mean maximum length of Lone Star bolls in Texas, 41 mm., was reached about 20 days after flowering. Although smaller, the late



bolls had a longer maturation period, 44.6 days, or about 2 days more than the early bolls. The mean maximum volume per boll of Pima cotton in Arizona, 14 cc., was attained in 25 days after flowering; mean maximum green weight per boll, 13.4 gm., in about 40 days; and mean maximum dry weight per boll, 3.8 gm., in about 50 days.

The period of maturation ranged from 45 to 80 days with normal Pima bolls in Arizona in 1921, the period lengthening for bolls of later flowering dates. This lengthening of the maturation period seemed due to the fact that the early bolls were smaller, they reached mature structural development in fewer days, and they reduced boll moisture to the opening stage more rapidly than the later bolls. Sea Island and Meade bolls in South Carolina reached their respective mean maximum volumes of about 19 and 29 cc. in 21 days, and their mean maximum green weights of about 16 and 27 gm. in 21 and 28 days, respectively, after flowering. The maturation periods averaged 57.6 days for Sea Island bolls and 56.1 days for the Meade bolls, and were found to increase as the season advanced.

**The clinging power of single cotton hairs,** A. ADDERLEY (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem., 1 (1922), No. 9, pp. 151-157, figs. 8*).—Investigations with fibers of five varieties of cotton indicated that the clinging power of cotton fibers depends upon the convolutions. This power is apparently a factor of importance in the spinning value of the cotton and the strength of the yarns spun from it, particularly with soft twisted yarns.

The clinging power is at a maximum when the convolutions of as many fibers as possible fit together perfectly. Perfect fitting may be obtained if the fibers have an equal number of convolutions evenly spaced along equal lengths, or, if fibers have varying total numbers of convolutions arranged in groups separated by unconvoluted spaces, the maximum clinging power is attained when the convolutions are identical in the different groups. However, the variability of any variety of cotton insures that the maximum clinging power is never realized in spinning, and the strength of a yarn will therefore be less than the ideal conditions imply.

**Cotton culture in Tennessee,** C. A. MOOERS and S. A. ROBERT (*Tennessee Sta. Bul. 127 (1923), pp. 19, figs. 6; also Tenn. Agr. Col. Ext. Pub. 117 (1923), pp. 19, figs. 7*).—Cultural methods and field practices are recommended for the production of cotton in the State, together with the results of experiments at the West Tennessee Substation.

Turning 6 in. and bedding either with good cultivation or weeds scraped off gave maximum average yields, but good returns were also secured with level planting, with 3-in. plowing with level planting, and with 3- or 6-in. bedding without plowing. Latter April to the middle of May seemed to be the best time for planting. Plants should be from 6 to 18 in. apart in the row on fertile soil. In the poorest years from 12- to 18-in. spacing was best, whereas in the best years yields did not vary appreciably whether plants were left 12 in. apart or unthinned. Plants thinned to 6 and 12 in. opened earlier than plants at wider or closer spacing. Express, Trice, Cleveland, and Mexican Big Boll are indicated as the most promising varieties.

Results of fertilizer experiments suggest the use of 200 lbs. of acid phosphate per acre, even on soils fairly well supplied with phosphorus, with a heavier application for the Highland Rim and East Tennessee soils. From 100 to 150 lbs. of sodium nitrate is advised. Although differences were not large, liming was apparently profitable for cotton and for other crops grown in rotation with cotton.

**The height of the hemp plant,** A. CHIAROMONTE (*Staz. Sper. Agr. Ital., 55 (1922), No. 10-12, pp. 421-433*).—Preliminary biometric studies on the varia-

bility of the height of hemp and the factors involved showed that Carmagnola, Bologna, and Ferrara may be considered as sufficiently homogeneous races. They not only come true to type in different generations and on different soils, but the frequency curves always possess a single apex, demonstrating the absence of marked mixture or segregation of characters. These strains did not exhibit signs of degeneration when grown in Campania. Several foreign strains such as Tekrouri, common French, and Anjou did not equal the Italian varieties, but Pelosella compared as to height with the latter.

**Giant oats**, S. SCHEGALOW (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 29 (1922), No. 3-4, pp. 207, 208).—Giant aberrants appearing in a family of a pure line derived from *Avena orientalis obsuata* at the plant breeding station of the Moscow Agricultural Institute possessed a double number of nodes, very thick culms, and broad leaves. Their late growth prevented the formation of inflorescences before the first fall cold. In the families where they appeared, the giant individuals made up from 17.6 to 21.2 per cent of the population. Inflorescences obtained by growing the giant plants on poor soil in small pots had many peculiarities. The anthers held pollen grains which were mostly empty, explaining the almost complete sterility of the plant. The seed of these oats produced giant individuals.

**Studies on certified seed potatoes**, B. A. BROWN and W. L. SLATE, JR. (*Connecticut Storrs Sta. Bul.* 114 (1923), pp. 285-296).—The progress of work with certified seed potatoes is reported on, as in an earlier publication (E. S. R., 46, p. 835).

Certified strains of potatoes at the station have averaged 62 bu. more marketable tubers than uncertified strains in 1920, 44 bu. more in 1921, and 53 bu. more in 1922. A distinct correlation seems to exist between the differences in favor of certified over uncertified strains of the several groups and the percentage decreases of the same groups after one year at Storrs. Since a low percentage of plants affected with degenerative diseases is the major prerequisite in raising certified seed potatoes, and as Green Mountains showed the greatest gain for certified seed, it is supposed that the Green Mountains are more susceptible to the degenerative diseases than either Rurals or Cobblers. This is corroborated by the experiences of growers. The comparative yields of certified seed of the Green Mountain group from Vermont, New York, and Maine do not justify the conclusion that much difference exists in the quality of the certified seed from the three States.

**Increasing the potato crop by spraying**, F. H. CHITTENDEN and W. A. ORTON (*U. S. Dept. Agr., Farmers' Bul.* 1349 (1923), pp. 11+22, figs. 23).—This is a revision of Farmers' Bulletin 868 (E. S. R., 38, p. 135).

**Researches into rice cultivation**, [K. V. JOSHI] (*Bombay Dept. Agr. Ann. Rpt.*, 1921-22, p. 57).—Continued work substantiated earlier findings (E. S. R., 48, p. 230) and indicated that variations in the age of seedlings at transplanting, in the number of seedlings planted per bunch, in the space allowed per bunch, and in vigor of seedlings as adopted by cultivators do not promise an increased yield or an appreciable economy in cost. Nitrogen seemed to have by far the largest influence in increasing the yield, phosphoric acid being of doubtful value in the trap soils.

**Statistics on the distribution and production of sugar cane varieties in Java in 1922-23**, J. VAN HARREVELD (*Arch. Suikerindus. Nederland. Indië, Meded. Proefsta. Java-Suikerindus.*, 1923, No. 3, pp. 95-116).—The distribution and yields of sugar cane varieties in Java (E. S. R., 48, p. 632) are tabulated for the season 1922-23. Varieties in order of importance were EK 28, DI 52, 247 B, EK 2, 100 POJ, 90 F, SW 3, 2714 POJ, and 2725 POJ, occupying,



respectively, 40, 21.5, 15.5, 6, 2.75, 3, 2.75, 2.75, and 1 per cent of the total acreage planted to cane on the island.

**Wrapping sugar cane**, G. S. KURUPAD (*Mysore Agr. Calendar, 1923, pp. 36, 37*).—Wrapping the stalks in a stool of sugar cane with dead leaves to prevent lodging and consequent rat damage has not paid in increased yields of cane and sugar for the expense when in 2-ft. rows, whereas in wider distances the increase more than covered the cost. Simply tying up of cane likely to lodge is suggested as a compromise.

**Melilotus indica on fall plant sugar cane**, W. G. TAGGART (*Louisiana Stas. Bul. 189 (1923), pp. 3-11*).—Tests at the Sugar Experiment Station showed that melilotus seeded on fall plant cane in October and turned under in the spring adds to the soil from 20,000 to 27,000 lbs. of green matter, containing over 100 lbs. of nitrogen. During five years an average increase of over 40 per cent in cane yields was obtained where melilotus was used as a catch crop without nitrogen fertilizer. Plats where melilotus was turned under March 2 made 14.08 tons of cane per acre, March 22, 16.36 tons, and without melilotus 10.46 tons, with the same trend as to stand. Seeding directions are given briefly.

**The culture of Turkish tobacco as exemplified in the Smyrna type**, W. A. WHITAKER (*Tobacco, 75 (1923), No. 26, pp. 14-21, figs. 25*).—A concise account of the production, manipulation, and marketing of Turkish tobacco in the Smyrna district.

**Kota wheat**, J. A. CLARK and L. R. WALDRON (*U. S. Dept. Agr., Dept. Circ. 280 (1923), pp. 16, figs. 6*).—Kota wheat (E. S. R., 48, p. 532) is described, with discussion of its origin, adaptation, resistance to stem rust, milling and baking value, and yields, as compared with those of Marquis.

Kota, a bearded wheat of the hard red spring class, ripens about as early as Marquis, is resistant to the principal forms of black stem rust in the hard red spring wheat region, and withstands drought fairly well. This variety has averaged about 3 bu. per acre more than Marquis in North Dakota in recent years and has given nearly equal results in milling and baking tests. Kota appears best adapted to the area where durum wheat is grown extensively, and could probably replace much of the durum wheat now raised in eastern North Dakota and South Dakota with profit to both the hard red spring and the durum wheat industries.

**Polish and poulard wheats**, J. H. MARTIN (*U. S. Dept. Agr., Farmers' Bul. 1340 (1923), pp. 11+10, figs. 3*).—The characteristics, histories, and adaptations of Polish (*Triticum polonicum*) and poulard (*T. turgidum*) wheats are set forth briefly. One variety of Polish wheat, White Polish, and four varieties of poulard, Alaska, Winter Alaska, Titanic, and Clackamas, are grown in the United States. Polish and poulard wheats often have been fraudulently exploited in this country under many different names, and farmers are advised against buying and growing varieties of these wheats, as only unsatisfactory returns have been obtained from them in all parts of the United States.

**Winter wheat in North Dakota**, L. R. WALDRON and T. E. STOA (*North Dakota Sta. Bul. 169 (1923), pp. 12, fig. 1*).—A revision of Bulletin 151 (E. S. R., 45, p. 831).

Winter wheat is not successful in the State when sown under ordinary methods of culture, because of lack of winter hardiness. However, a few farmers have grown the crop successfully, especially during recent years, by seeding rather early in tall, clean grain stubble. When the wheat gets a good start in autumn and spring conditions are not too severe, the stubble affords sufficient protection to keep enough plants alive to make a crop. Even when

winter wheat has not outyielded spring wheat, it has been considered a success as a partial supplement of the spring wheat acreage because of the better distribution of farm labor and the partial control of annual weeds.

Winter wheat seeded in standing cornstalks for a series of years at Dickinson (E. S. R., 48, p. 224) has yielded 13 bu. per acre as compared to 17.2 bu. from Marquis spring wheat. The average yield of Beloglina winter wheat during 10 years at Williston (E. S. R., 48, p. 224) was 14.1 bu. per acre as compared to 29.4 bu. from Power, a hard red spring wheat.

Pending publication of a bulletin on winter rye, the authors indicate that the hardier varieties of winter rye can be seeded on plowed land with success. Protection afforded by corn stubble, when present, is of value, but fall pasturing of winter rye, unless sparingly done, usually tends to injure the stand. Stubbling in winter rye offers added winter protection to the crop, and may be justified where the land is not too foul with weeds. Seeding from 4 to 5 pk. per acre of Dakold winter rye by September 15 is suggested for best results. Preliminary tests have not shown seeding grasses or legumes with rye in the fall to be desirable.

**Methods of covering grass and clover seeds,** R. D. WILLIAMS (*Jour. Min. Agr. [Gt. Brit.]*, 29 (1923), No. 12, pp. 1125-1134).—Further investigations (E. S. R., 47, p. 829) at Aberystwyth, Wales, concerned the methods of covering seed of Italian rye grass, perennial rye grass, cocksfoot [orchard grass], red clover, and white clover under field conditions and employing only the farm implements ordinarily used for this purpose.

Good catches of red clover and white clover, and to a lesser extent of Italian rye grass, perennial rye grass, and cocksfoot, depended more on the thoroughness with which the seeds were covered than on any other factor usually involved when sowing small seeds. None of the implements under investigation buried the seeds too deeply, hardly any being covered to a depth of more than 0.05 in., even by the peg harrow. The peg harrow and chain harrow were the most effective implements studied for covering the grass and clover seeds on all the types of soils experimented upon. The uncovered seeding and plats covered by a smooth roller gave fairly good results for the grass seeds, but very poor catches for clover. The horse hayrake and the Cambridge roller were not so effective in covering red clover seeds as the two harrows, but were superior for covering trial plats. The chain harrow was particularly unsuitable for this purpose as it was apt to drag seeds from plat to plat. A very fine powdery surface gave a poorer stand than a slightly irregular surface consisting of lumps ranging from 0.25 to 0.75 in. in diameter.

Poor catches of red clover were obtained on plats sown when the surface soil was wet, because the seeds clinging to the wet soil could not be properly covered. Seeding red clover on a very dry soil during a long period of drought which delayed germination for nearly a month gave excellent results. The loss of viable red clover seeds amounted to from 4 to 7 lbs. per acre, even when the seeds were covered by the most effective implements.

**"Daylight" germination best method for some varieties of seed,** G. WIERINGA (*Seed World*, 13 (1923), No. 12, pp. 31, 40, figs. 4).—Investigations in progress at the State Seed Testing Station, Wageningen, Netherlands, disclosed that most of the samples of orchard grass, redtop, timothy, foxtail, Kentucky blue grass, and rough stalked meadow grass germinated better in diffused light or sunlight than in darkness, while about half of the meadow fescue samples germinated best in darkness. The influence of daylight on the germination of Canada blue grass was shown by an average germination of about 17 per cent in darkness, 62 in diffused light, and 94 in sunlight.



**Report of the seed commissioner for the biennium 1921-1922, C. B. AHLSON** (*Idaho Sta. Circ. 31 (1923), pp. 16, figs. 2*).—This report includes the text of the Idaho seed law, official grades for the sale and shipment of seed of legumes, a summary of the results of tests on 5,911 special samples, and the results of examinations of 103 official samples collected during the biennium.

Comparison of the number of samples of seed analyzed, the percentage condemned, and the price per bushel of red clover during the years from 1913 to 1922, inclusive, showed that, in general, during the period of high prices fewer samples are sent to the laboratory for analysis. In the two years following the peak of prices the quality of the seed produced is inferior, i. e., a higher percentage of the seed analyzed is condemned. During high prices growers appear to sell all seed on which they can realize high returns and consequently use inferior seed to plant.

**Seed certification and listing, H. L. BOLLEY and O. A. STEVENS** (*North Dakota Sta. Circ. 21 (1923), pp. 4, figs. 2*).—A revision of Seed Circular 10 (issued in November, 1913) giving rules and regulations governing the registration and certification of pedigreed and improved seed of field crops, particularly potatoes.

**North Dakota pure seed law: Interpretations and suggestions, H. L. BOLLEY and O. A. STEVENS** (*North Dakota Sta. Circ. 20 (1923), pp. 8*).—This is a revision of Special Seed Bulletin 2 (*E. S. R., 30, p. 342*).

## HORTICULTURE.

**On the amount of stable manure necessary for vegetable growing, B. L. HARTWELL and F. K. CRANDALL** (*Rhode Island Sta. Bul. 195 (1923), pp. 3-16*).—This bulletin discusses the results secured in a period of 6 years with the following 3-year rotation: (1) Beets followed by cauliflower, (2) spinach followed by carrots, and (3) eggplant alone. In addition, a test was made of the same rotation modified by substituting a mixed crop of Italian rye grass and clover for the cauliflower. Since a permanent objective of the experiment was to ascertain to what extent manure applications could be reduced, a comparison was made between 32 and 16 tons of manure per acre applied in the spring and supplemented in both instances by chemical fertilizers, which in the case of the 32-ton treatment were applied only in the spring and in the instance of the 16-ton treatment were applied both to the spring and summer sown crops in the first two years of the rotation.

In the regular rotation, beets and eggplant failed to produce as large crops with 16 tons of manure plus fertilizer as with 32 tons plus fertilizer. On the other hand, in the modified rotation, where cauliflower was replaced by rye grass and clover the yield of all crops with 16 tons of manure and fertilizer compared favorably with those obtained in the unmodified rotation with 32 tons of manure plus fertilizer. A reduction of the manure to 8 tons in the modified rotation did not materially affect the yield of beets and spinach and carrots, but did reduce the yield of eggplant.

Results secured on another group of plats carried on for the purpose of studying the effects of subsoiling, graveling, and the substitution of shavings and sawdust for straw in the manure, indicated that on the soil type utilized, with the exception of the carrots, such treatments tend to slightly increase yields. The use of 8 tons of manure supplemented with a fertilizer containing an excess amount of nitrogen resulted in higher yields in the case of beets and eggplant and lower in the case of spinach and carrots than were obtained either with 16 or with 8 tons of manure plus regular fertilizers. The application of peat composted with lime resulted in decidedly inferior

yields, except in the case of carrots. The application of additional acid phosphate at the rate of 2 tons per acre to the peat areas tended to correct the deleterious effect.

**Report on vegetable investigations, J. P. GRIFFITH** (*Porto Rico Dept. Agr. and Labor Sta. Circ. 62 (1923), Spanish ed., pp. 17*).—Following a preliminary discussion of vegetable culture, including seed selection, planting, cultivation, and combating of insect and fungus pests, a report is given upon the results of tests with various species and varieties of vegetables.

**Spinach studies in Passaic County and cultural notes, L. G. SCHERMERHORN** (*New Jersey Stas. Bul. 385 (1923), pp. 11, figs. 6*).—This is a brief preliminary report upon the results of varietal and fertilizer studies with spinach. Of 14 varieties tested, the Norfolk Savoy, Thick-Leaved Viroslay, and the Round-Seeded Savoy were, in the order given, the most productive. In respect to fertilizers, the maximum yield was obtained from that plot receiving 1,600 lbs. of a 9-8-3 fertilizer at time of planting. The same amount of material applied in installments failed to give as good results, leading the author to conclude that for fall spinach all the fertilizer should be applied previous to planting. The unsatisfactory results obtained from the addition of manure leads to the suggestion that where manure is to be used upon fall spinach it should be applied long enough before planting to allow for thorough mixing with the soil.

[**Horticultural activities at the Morden, Man., Experimental Station**], W. R. LESLIE (*Canada Expt. Farms, Morden (Man.) Sta. Rpt. Supt. 1922, pp. 20-57, figs. 2*).—This is for the most part a report upon tests of fruit varieties and seedlings, many of the latter of which have originated at the station. Out of 25,000 apple seedlings set out in 1916, 327 had fruited by 1922. However, of these only a very few showed sufficient promise for further study. With a view to introducing hardiness, native plum and cherry species have been extensively used in breeding operations. A comparison of grafting waxes indicated that Parowax is a satisfactory material, giving as good or even better results than the old style wax. Varietal tests with vegetables are likewise reported.

**Experimental accuracy in fruit breeding, W. S. MALLOCH** (*Amer. Nat., 57 (1923), No. 652, pp. 435-442*).—Admitting the peculiar difficulties incident to carrying on fruit breeding projects, namely the large size, heterozygosity, and long life of the materials utilized, the author urges the importance of using the most exacting technique in experiments of this nature, and cites examples of investigational work which he considers to be imperfect.

**Catalase activity as an indicator of nutritive condition of fruit tree tissues, A. J. HEINICKE** (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 209-214*).—Records taken on the time required by the catalase in 1 cc. of apple leaf or bark preparations, taken from trees receiving contrasting treatments, to obtain 5 cc. of oxygen from 2 cc. of hydrogen peroxid indicated that catalase activity may be of value as a measure of the response of fruit trees to different treatments. In general, those conditions or treatments promoting vegetative activities tended to increase the catalytic activity of the tissue with reference to hydrogen peroxid, while conditions decreasing vegetative activity tended to lessen catalase activity. On the assumption that the nitrogen content of the tissues increases with strong vegetative tendencies and that carbohydrate constituents increase with weak vegetative tendencies, the author believes that a relatively high catalase activity accompanies a nutritive condition in which the proportion of nitrogen to carbohydrates is high. On the other hand, a decreased nitrogen content or a large proportion of carbohydrates to nitrogen decreases catalase activity. It is believed that the results of the



test suggest that catalase activity may possibly be an expression of the carbohydrate nitrogen ratio proposed by Kraus and Kraybill (*E. S. R.*, 40, p. 40).

The results of unpublished studies by E. C. Auchter upon the nitrogen content of leaves used in catalase activity tests showed a marked relationship between catalase activity and nitrogen content in the case of the peach. In the case of oak and apple, where the nitrogen content of the leaves was less markedly influenced by experimental treatments, the results indicated that catalase activity is stimulated by increases in nitrogen and decreased by increases in carbohydrates. In general conclusion, the author suggests that catalase tests show promise of value in biological studies involving frequent determinations of the same material and also have possibilities of application in studies of general nutritional changes which are normally going on within plant tissue.

**Correlation of orchard practice with growth and production**, R. H. ROBERTS (*Iowa State Hort. Soc. Rpt.*, 57 (1922), pp. 202-205).—Emphasizing the fact that all growth in a tree is directly related to nutritional conditions within and only indirectly related to external environment, the author discusses the internal conditions existing within an apple tree, points out their bearing on vegetative and fruit bud development, and urges that cultural and fertilization practices be based upon the tree itself, adopting that plan of management which best maintains the tree in a thrifty and productive state.

**The cause and permanence of size differences in apple trees**, K. SAX and J. W. GOWEN (*Maine Sta. Bul.* 310 (1923), pp. 8, pl. 1, fig. 1).—In 1914 an orchard consisting of 10 varieties (buds of each variety taken from a single parent tree) was established at the station. Trunk circumference records taken each autumn from 1916 to 1922 on the trees show that not only are the trees extremely variable in size but also that these variations are relatively permanent. Trees small in 1916 were found to be relatively small in 1922, and, reciprocally, those large in 1916 were in general large in 1922. Dividing the 208 now living trees into groups according to their trunk circumferences in 0.5 cm. classes in 1916, it was found that the groups maintained their relative positions quite constantly from year to year. As a result of the studies, the authors conclude that, although unknown factors may have entered into the results, probably the differences in vigor of the original seedling stocks have been the causes of at least some of the permanent differences in size of the young trees. It is believed that larger grades of nursery trees will usually result in larger and more productive trees than will smaller trees of the same age. It is recommended that growers secure the best grade of 1-year-old nursery trees.

**Apple breeding for the upper Mississippi Valley**, H. L. LANTZ (*Iowa State Hort. Soc. Rpt.*, 57 (1922), pp. 160-167).—Following a brief discussion of the past and present status of apple breeding in the area covered, the author presents the names of parental apple combinations which have yielded meritorious seedlings at the Iowa Experiment Station.

**The investigational work with pears at the Georgia Experimental Station**, H. P. STUCKEY (*Iowa State Hort. Soc. Rpt.*, 57 (1922), pp. 169-172).—Records taken on the blight-resisting qualities of a large number of pears have shown that all varieties, with the exception of one locally known as Pineapple, have succumbed to such an extent as to eliminate them from commercial consideration. In connection with a technical description of tree and fruit, notes are given concerning the history and uses of the Pineapple variety.

**Fruit bud formation in Rubus and Ribes**, L. H. MACDANIELS (*Amer. Soc. Hort. Sci. Proc.*, 19 (1922), pp. 194-200).—This is a report of investigations

conducted at Cornell University to determine the time of fruit bud differentiation and the nature of buds on the different parts of various small fruits. Microscopical examination of buds collected at numerous periods showed Cumberland black raspberry flowers to be differentiated in late fall, presumably in early October, whereas Herbert red, Golden Queen yellow, and Columbian purple raspberry blooms showed no well-defined differentiation in the fall. Snyder blackberry blossoms were differentiated about the last of August. Houghton gooseberry the first week in August, and Cherry red currant flower buds in late July or early August.

Examination of buds of raspberry and blackberry canes pruned back to various lengths indicated that all buds are potentially fruit buds. It is believed that a large proportion of the buds, with the possible exception of those near the base of the cane, are differentiated in the season preceding fruiting. Buds with growing points not differentiated may either form terminal flower clusters and bear fruit a little later than the normal season, or, as is frequently the case in the blackberry, may form vegetative shoots only.

**The cranberry industry and its possibilities in Canada**, M. B. DAVIS (*Canada Dept. Agr. Bul. 19, n. ser. (1923), pp. 27, figs. 20*).—This revision of a previously noted bulletin (E. S. R., 36, p. 240) relates to the development and management of commercial cranberry bogs. Among the subjects considered are the selection of sites, drainage, preparation of land, dyking, planting, flooding, sanding, fertilizing, pruning, harvesting, and combating insect and fungus enemies. The pamphlet is abundantly illustrated.

**The influence of notching on the yield of the fig trees**, G. S. CHEEMA and S. R. GANDHI (*Agr. Jour. India, 18 (1923), No. 5, pp. 501-504, fig. 1*).—Dormant buds on long leafless fig shoots were induced to break forth into growth by simply cutting, with the aid of a sharp knife, a notch into the wood just above the bud. About four days after this treatment the bud was observed to become swollen and after eight days to commence growth, and in two months the resulting shoots attained a length of 2 ft. When notching was performed during July the resulting shoots became sufficiently large to bear during the subsequent fruiting period. The advantages of notching consist not only in increasing yields but in improving the shape and appearance of the tree by promoting an abundant growth of thrifty laterals.

**Culture of citrus fruits in the Gulf States**, E. D. VOSBURY and T. R. ROBINSON (*U. S. Dept. Agr., Farmers' Bul. 1343 (1923), pp. II+42, figs. 14*).—This is a revision of and supersedes Farmers' Bulletin 1122 (E. S. R., 44, p. 44).

**The citrus industry in the lower Rio Grande Valley of Texas**, J. M. DELCURTO and E. W. and H. F. HALSTEAD (*Texas Dept. Agr. Bul. 75 (1923), pp. 119, figs. 83*).—The present status of citrus growing in this region is discussed, and information is presented relative to varieties, culture, pruning, and combating insect and fungus pests.

**The Satsuma orange in south Mississippi**, E. B. FERRIS and F. B. RICHARDSON (*Mississippi Sta. Bul. 217 (1923), pp. 28, figs. 5*).—This bulletin is prepared in two parts, as follows:

*Experiments with citrus fruits at McNeill, Miss., 1908 to 1923*, by Ferris (pp. 3-10).—An outline of the history of an experimental citrus planting, which despite the lack of specialized care showed that Satsuma oranges could be grown successfully when grafted on trifoliate stocks. Varieties such as Ruby, Pineapple, Parson Brown, Carlton, Madame Vinous, and Dugat were practically failures.

*The Satsuma orange in south Mississippi*, by Richardson (pp. 11-28).—This discusses citrus growing from all angles, including selection of site, prepara-



tion of land, varieties, propagation, culture, fertilizers, pruning, control of insect pests, harvesting, marketing, etc.

**A biological study of the coffee blossom**, H. R. M. DEHAAN (*Meded. Proefsta. Malang*, No. 40 (1923), pp. 97, figs. 6).—A report of an investigation conducted at the Experimental Station at Malang, Java, in which the author studied the morphology of the coffee flower, bud formation, factors influencing formation, manner of pollination, and rate of growth in the pollen tubes in *Coffea robusta*. He found that pollination was largely accomplished by the wind and only slightly dependent upon insects. Since successful setting of the berry was found to be dependent upon satisfactory weather conditions, the author suggests that coffee plantations should consist of early, midseason, and late blooming varieties.

**Tea**, E. PERROT (*Min. Com. et Indus., Off. Natl. Matières Vég. [France]*, Not. 14 (1923), pp. 48, pls. 4, figs. 2).—This pamphlet contains general information relating to the history of the tea plant, its culture, and the preparation and handling of the commercial product.

**Vanilla, vanillin, and vanilla extract**, W. L. UTERMARCK (*Kolon. Inst. Amsterdam, Afd. Handelsmus. Meded.* 3 (1922), pp. 116, pl. 1, figs. 4).—A discussion of vanilla in relation to its botany, culture, and manufacture into vanillin and vanilla extracts.

**Dates and date cultivation of the Iraq, I-III**, V. H. W. DOWSON (*Mesopotomia Agr. Dir. Mem.* 3 (1921), pts. 1, pp. [4]+75, pl. 1, figs. 54; 2, pp. [3]+26, figs. 7; pt. 3 (1923), pp. V+97, pls. 2, figs. 53).—This memoir is presented in three parts, as follows: (1) The cultivation of the date palm on the Shat-el-Arab, (2) the results of an investigation into the yield of date palms on the Shat-el-Arab, and (3) the varieties of date palms of the Shat-el-Arab.

**Dahlias in the garden**, C. H. CONNORS (*New Jersey Stas. Circ.* 154 (1923), pp. 24, figs. 17).—This is an illustrated pamphlet containing general information relative to the culture of the dahlia, methods of propagation, classification, and varieties.

**Flowers for cutting and decoration**, R. WRIGHT (*New York: E. P. Dutton & Co.*, 1923, pp. XI+218, pls. 16, fig. 1).—A popular discussion.

**A little book of perennials**, A. C. HOTTES (*New York: A. T. De La Mare Co., Inc.*, 1923, pp. 170, figs. 81).—Arranged alphabetically according to genera, this booklet contains information relative to the uses, culture, and propagation of various ornamentals.

## FORESTRY.

**The national forests of the southern Appalachians** (*U. S. Dept. Agr., Forest Serv.*, 1923, pp. 24, figs. 35).—This illustrated pamphlet directs attention to the scenic features of the areas considered and stresses the importance of fire prevention and general conservation.

**Report of James Bay forest survey, Moose River Lower Basin, 1922**, R. N. JOHNSTON, J. F. SHARPE, ET AL. (*Toronto: Ont. Dept. Lands and Forests*, 1923, pp. 16, pl. 1).—A presentation of data obtained as the result of aerial mapping.

**Reports on forest administration in the Andamans for the years 1920-21 and 1921-22**, J. W. BRADLEY (*Andamans Forest Admin. Rpts.*, 1920-21, pp. III+42; 1921-22, pp. III+48).—The usual annual reports (*E. S. R.*, 46, p. 238), containing chapters on the constitution and management of the State forests, financial results, research experiments, administration, and general information, together with much tabular data.

Annual reports of the forest administration in Ajmer-Merwara for the nine months July, 1920, to March, 1921, and for the year 1921-22, SHAMBHOO DUTT and DAYANAND MAMGAIN (*Ajmer-Merwara Forest Admin. Ann. Rpts.*, 1920-21, pp. 36; 1921-22, pp. 30).—The usual reports on forest administration in Ajmer-Merwara, with data relative to alterations in forest area, forest protection, revenues and expenditures, etc., appended in tabular form (E. S. R., 45, p. 646).

Report of the forest administration in the Bombay Presidency, including Sind, for the year 1921-22 (*Bombay Forest Admin. Rpt.* 1921-22, pp. 111+3).—The usual annual report (E. S. R., 48, p. 142).

Reports on forest administration for the years 1921 and 1922, G. E. S. CUBITT (*Fed. Malay States Forest Admin. Rpts.*, 1921, pp. 38; 1922, pp. 40).—The usual annual reports (E. S. R., 47, p. 444).

Common forest trees of South Carolina: How to know them, W. R. MATTOON and D. B. ROSENKRANS (*Clemson Agr. Col. S. C., Ext. Bul.* 55 (1923), pp. 72, figs. 70).—In a way similar to that prepared for Virginia (E. S. R., 49, p. 239), this pocket manual describes 70 common forest trees of South Carolina and gives notes on the value of the wood. Drawings of the twigs, leaves, and fruiting parts accompany the description of each species.

The comparative fire resistance of Douglas fir and redwood, R. E. WORTHINGTON (*Wash. [State] Univ., Forest Club Quart.*, 2 (1923), No. 1, pp. 12-14, figs. 2).—Ignition tests with thoroughly dried pieces of Douglas fir and redwood cut from the longitudinal surfaces of pieces of medium density, in the form of 1-in. squares 0.12 and 0.26 in. in thickness, showed that Douglas fir resists combustion to a greater degree than does redwood. At temperatures below 460° C. (860° F.) combustion did not take place, and the material distilled away rapidly. At temperatures above 600° the wood burned so quickly that no accurate record could be obtained.

Note on kindal or hongal (*Terminalia paniculata* W. & A.), R. S. PEARSON ([*Indian*] *Forest Bul.* 48 (1922), pp. 12, pl. 1).—Accompanying a veneer specimen of the wood, information is given relative to the distribution and botanical and silvicultural characters of *T. (Pentaptera) paniculata*.

The cultivation of cork oaks and production of cork in Spain, E. CARO (*Internatl. Rev. Sci. and Pract. Agr. [Rome]*, n. ser., 1 (1923), No. 2, pp. 322-330, pls. 2).—This is a general article discussing habitat, management and utilization, rotations, bark collection, etc.

Parana pine lumber industry of Brazil, J. C. KIRCHER (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform. Bul.* 92 (1923), pp. II+18).—This pamphlet contains general information concerning the Parana pine (*Araucaria brasiliana*), a species comprising approximately 20 per cent of the Brazilian forests, and which at the present time is being cut extensively for supplying local needs, not only in Brazil but also in Argentina and Uruguay. The quality of the timber, although not equal to that of pine obtained from the United States, is sufficiently high to make the Parana pine a material factor in competing for the North American trade.

An investigation of certain factors concerning the resin-tapping industry in *Pinus longifolia*, H. G. CHAMPION ([*Indian*] *Forest Bul.* 51 (1922), pp. 20).—With a view to ascertaining the rate of occlusion of old channels in *P. longifolia*, observations were made on trees of different ages growing at different elevations and exposures.

It was found that age has a direct effect upon the occlusion of channels. On a basis of 100 for mature trees, immature graded at 98 and overmature at 49. Trees with well developed crowns healed more rapidly than did those with less perfect crowns. In respect to altitude, the rate of occlusion was



most rapid between 5,000 and 6,000 ft. elevation, dropping off at lower and at higher levels. Healing was most favorable on northern and western aspects, poorest on southern, and intermediate on easterly exposures. Even in the case of individual trees, those channels located on the northern side healed most readily. No significant effect was noted on the rate of occlusion of channels on comparable trees which had rested different lengths of time since tapping. Observations on single channels showed that healing was almost always most rapid at the top and bottom of the channel.

In general conclusion, it is pointed out that the rate of occlusion of the channels made in resin tapping operations on *P. longifolia* depends primarily on the general vigor of the tree, its stage of maturity, development of the crown, and height growth, and secondarily upon an adequate supply of water and nutrients reaching the edges of the wounds.

**Investigations on the occurrence of caoutchouc and latex vessels in the leaves of *Hevea brasiliensis*, W. BOBILIOFF** (*Arch. Rubbercult. Nederland. Indië*, 7 (1923), No. 5, pp. 205-216, figs. 3).—Determinations of the amount of caoutchouc in the leaves of trees of known productivity showed no correlation whatsoever between leaf content and yielding capacity of the tree. A study of position of the latex vessels in the leaves leads the author to believe that the vessels do not function as conveyors of food material but serve rather for the storage of caoutchouc, a material which is believed to be purely an excretory product. This assumption is further borne out by the fact that the wintering leaves contained a slightly higher percentage of caoutchouc than did leaves during the growing season.

**Demonstration courses in kiln drying, boxing and crating, gluing of wood, wood properties and uses** (*U. S. Dept. Agr., Misc. Circ.* 8 (1923), pp. 20, figs. 13).—Details are given concerning demonstration courses offered by the Forest Products Laboratory, U. S. D. A. Forest Service, in kiln drying of lumber, boxing and crating, gluing of wood, and properties and uses of wood. Stress is laid on the practical aspects of the subjects with a view to assisting factory and sawmill executives, foremen, kiln operators, and other persons engaged in handling lumber or lumber products.

**Pulp-wood consumption and wood-pulp production, 1920, R. V. REYNOLDS and A. H. PIERSON** (*U. S. Dept. Agr., Forest Serv.*, pp. 39, figs. 4).—Prepared in a similar manner to that for the year 1918 (*E. S. R.*, 42, p. 144), this pamphlet contains detailed statistics on pulp-wood consumption and wood-pulp production in the United States in 1920. A map is included showing the geographical distribution of wood-pulp mills in North America in 1921.

## DISEASES OF PLANTS.

**The relation of air temperature to certain plant diseases, J. JOHNSON** (*Phytopathology*, 11 (1921), No. 11, pp. 446-458, pls. 3, figs. 2).—A description is given of chambers used in this investigation in which the air temperature and humidity were controlled within relatively narrow limits. With this apparatus a study was made of the influence of air temperature on the mosaic disease of tobacco, a bacterial leaf spot of tobacco due to *Bacterium tabacum* and the late blight of potato (*Phytophthora infestans*).

The optimal temperature for the development of the different diseases was determined, and in the case of mosaic disease lies between 28 and 30° C., for the wildfire of tobacco between 28 and 32°, and for the *Phytophthora* blight of potato above 25 and below 32°. The maximum temperatures are also stated. The activity of the enzymes to which mosaic has been attributed did not appear to be lowered by the maximal temperatures, and the enzymes are therefore believed to be an effect rather than a cause of the disease.



[Diseases of cacao and other plants, St. Thomas], A. F. DE SEABRA and N. PATOUILLARD (*Mém. Soc. Portugaise Sci. Nat., Sér. Zool., No. 2 (1922), pp. 70, 71, 87-97, figs. 2*).—These sections of this report (which also deals with animal pests) give accounts of fungus diseases of trees in St. Thomas, relating more particularly to cacao as affected by *Stemonites splendens*, *Daldinia concentrica*, *Trametes persoonii*, *Polyporus lignosus*, *Hexagona discopoda*, and *Gonoderma fulvellum*; by the drying up of the branches (*Corticium javanicum*, *Botryodiplodia theobromae*, and *Nectria* sp.); by gafa (*Cephaleuros virescens*, *N. albiseda* n. sp. (*Fusarium theobromae*), *Phoma theobromae* n. sp., and *Anthromycopsis filiformis* n. sp.); by mela (*Colletotrichum theobromae*, *Stilbum scabre* n. sp. and *N. ochroleuca*); and by nematodes (*Heterodera radicicola*).

[Plant diseases, Federated Malay States], F. W. SOUTH (*Agr. Bul. Fed. Malay States, 9 (1921), No. 3, pp. 201-203*).—Disease and pest control measures as reported under work of the inspection staff, July to September, 1921, relate to rubber tree pink disease, moldy rot, black stripe, patch canker, and insect enemies.

Report of the imperial mycologist [Pusa, 1921-22], W. McRAE (*Agr. Research Inst., Pusa, Sci. Rpts., 1921-22, pp. 44-50*).—This section contains condensed accounts of rice parasitic fungi, sugar cane mosaic, jute diseases in relation to manures, systematic work, and a program of plant disease work for the coming year.

Some relations of the crown gall organism to its host tissue, A. J. RIKER (*Jour. Agr. Research [U. S.], 25 (1923), No. 3, pp. 119-132, pls. 5*).—Preliminary to a study of control measures for crown gall on raspberries, blackberries, etc., the author conducted an investigation of the disease on the tomato, which is readily infected by the organism *Bacterium tumefaciens*. As a result of the experiment it is believed that crown gall bacteria are located in certain intercellular spaces of the host tissue, and that they are present in much larger numbers than has been supposed.

Crown gall infection in tomato stems was found to take place only through wounds, and it was not necessary for infection that the organisms should be carried into the wound at the time of puncture. When a continuous channel of liquid was provided in the tomato stem either by mechanical pressure or by freezing, the bacteria migrated and produced galls several centimeters from the point of inoculation. When the organisms were introduced into a wound which cut some of the vascular bundles, they appeared to travel in some part of the conductive tissue, probably the tracheae, and when a wound enabled them to escape, induced proliferation.

The usual methods of staining are said to fail to demonstrate the bacteria in position.

The parasitism of *Colletotrichum lindemuthianum*, J. G. LEACH (*Minnesota Sta. Tech. Bul. 14 (1923), pp. 3-41, pls. 8, figs. 6*).—The results are given of a study of the parasitism of *C. lindemuthianum* as a contribution to the solution of the general problem of disease resistance in plants. The author claims that at least 8 distinct biologic forms of *C. lindemuthianum* were found as a result of comparative inoculation tests made with 15 cultures on 14 varieties of field beans. The size of the lesions produced on a susceptible bean plant when inoculated was found to be inversely proportional to the age of the tissue inoculated, the older the tissue the smaller the lesion. The age of the tissue in highly resistant varieties had no effect on the size of the lesions. It is claimed that the size of the spores was influenced by the medium on which they were produced, but the different biologic forms were not influenced in the same way by the same medium. The temperature relations of the fungus and its behavior in various media were determined. All efforts to change the parasitic capabilities



of a biologic form were unsuccessful, as were also all efforts to break down host resistance.

Penetration of the epidermal cell wall was found to be accomplished in the same manner on susceptible and resistant varieties of beans. In young tissue of a susceptible variety the infection hypha rapidly enlarged into a normal mycelium and continued its growth. In old tissue of susceptible varieties the mycelium was retarded in its development by increased resistance of the cell walls. In a highly resistant variety seldom more than one or two cells were attacked, and the hyphae were soon disintegrated, resulting in the death and disintegration of the host protoplast. This is considered to be a nutritional phenomenon, the mycelium being destroyed by autolysis induced by starvation and the resulting products killing and staining the host cells.

**Further studies on physiology of *Rhizoctonia solani*,** T. MATSUMOTO (*Bul. Imp. Col. Agr. and Forestry, Japan*, No. 5 (1923), pp. [1]+64, pl. 1, figs. 8).—A conclusion reached in the paper previously noted (E. S. R., 46, p. 325) was to the effect that the strains studied by the author, with few exceptions, might have been derived from a single strain, although some marked physiological and morphological specializations were observed. In the present paper the attempt is made to obtain some additional data concerning the evidence of specialization manifested by some individuals of a single strain, when they were placed under diverse environmental conditions. Interest is centered also on studies of the physiology of the fungus in question. The present paper is intended to serve as a supplementary report by showing to what extent a single strain can exhibit specialization in physiological behaviors under the influence of changes in the culture media or other several environmental conditions, also by presenting additional data concerning the physiological characteristics of the fungus. This is done in considerable tabular, descriptive, and discussional detail.

**Vegetative vigor of the host as a factor influencing susceptibility and resistance to certain rust diseases of the higher plants,** M. A. RAINES (*Amer. Jour. Bot.*, 9 (1922), No. 4, pp. 183-203).—From studies on the cereal rusts the author has concluded that health and vigor of the host favor rather than hinder its inoculation by a rust and the further development of the diseased condition. The evidence bearing more or less directly on the main conclusion is given in detail, partly in connection with factors related to the state of the host.

**The rôle of the genus *Rhamnus* in the dissemination of crown rust,** S. M. DIETZ (*U. S. Dept. Agr. Bul.* 1162 (1923), pp. 19, figs. 8).—In continuation of previous studies (E. S. R., 47, p. 542) the author gives an account of the rôle of certain species of *Rhamnus* in the dissemination of crown rust of oats. The introduced species (*R. cathartica*) and the native species (*R. lanceolata*) are considered to be the most common hosts of the crown rust in Iowa, and a number of epidemics of rust on oats have been traced to these host plants. Other species of *Rhamnus* are somewhat subject to infection by the fungus, but they are considered relatively unimportant in the dissemination of the rust.

**Fungicidal dusts for the control of bunt,** W. W. MACKIE and F. N. BRIGGS (*California Sta. Bul.* 364 (1923), pp. 533-572, pls. 3, figs. 12).—A detailed account is given of the cooperative investigations previously reported upon in part (E. S. R., 47, pp. 245, 647). The authors describe in detail experiments in treating seed wheat for the prevention of bunt in which known quantities of spores were added to susceptible varieties of wheat. Many fungicidal solutions while found destructive to bunt spores delayed or injured the germination and growth. Copper sulphate is said to repress root

growth and formaldehyde that of plumule development. Treatments with solutions were found to reduce germination. Sulphur reduced the occurrence of bunt where the quantity of smut on the seed was light, but is not considered a dependable fungicide. The principal experiments were carried on with copper carbonate and comparisons made with copper sulphate powder. The copper sulphate in dust form is difficult to obtain on account of its absorbing moisture, and if it is to be used the anhydrous copper sulphate is recommended.

On the whole copper carbonate dust applied to seed wheat at the rate of 2 oz. per bushel gave very satisfactory control. This treatment did not injure the seed and germination was not inhibited, but, on the contrary, the seed germinated earlier and made more vigorous growth than seed treated with solution. Experiments were conducted on the dilution of copper carbonate dust, but the authors do not consider this practice warranted. The best standard for effective copper carbonate dust is said to be copper in the form of copper carbonate 52 to 54 per cent and copper hydrate 39 to 42 per cent, and of sufficient fineness to pass through a 200-mesh sieve.

Experiments made with organic mercuric fungicides were found to give excellent results as liquids. The amount of bunt in a crop was found to depend in a large part upon the quantity of bunt spores borne by the kernel, the percentage of bunt decreasing with the decrease in the spore dosage.

**H-ion concentration in its relation to wheat scab**, E. F. HOPKINS (*Amer. Jour. Bot.*, 9 (1922), No. 4, pp. 159-179, figs. 18).—In the experiments here reported as undertaken to determine the relation of H-ion concentration to wheat scab, it was desired to find, if existing, a limiting acidity for seedling infection of wheat by the causal organism (*Gibberella saubinetii*).

The study of this organism shows that, although a wide range of acidity is tolerated, there is a minimum in the growth curve. This minimum was found in three different series of cultures. In the first series the reaction of a liquid medium was adjusted by means of sulphuric acid and sodium hydroxid; in the second, primary and secondary potassium phosphate, phosphoric acid, and potassium hydroxid were used in a liquid medium; and in the third, the acidity of potato-dextrose agar was varied by means of lactic acid. The minimum point in the curve varied from pH 5.5 to pH 6. This is said to be similar to the results reported by Webb from his work on spore germination and H-ion concentration (*E. S. R.*, 42, p. 224). The use of various substances to change the reaction shows that the effect on the growth is due to the H-ion concentration and not to other molecules or ions.

A correlation appears in the relation of soil acidity to seedling infection, from which a relation is inferred between the effect of acidity on the growth of the pathogene and its effect on infection. Furthermore, it appears from results obtained regarding the effect of acidity on the rate of germination of wheat in the control experiments, which also shows a minimum, that there is also an effect of the H-ion on the host which causes a depression in the infection curve. How this comes about is not certain, but it is thought that both these phenomena affect the severity of the infection. The question regarding the cause of the depression in these curves seems to require further study of H-ion concentration in its relation to other factors.

**Bacterial spot of Lima bean**, W. B. TISDALE and M. M. WILLIAMSON (*Jour. Agr. Research* [U. S.], 25 (1923), No. 3, pp. 141-154, pls. 3).—A spot of Lima bean is described which has been observed in gardens in southeastern Wisconsin for several years. The disease was said to have been very severe in the vicinity of Madison, Wis., during the season of 1917. All varieties of Lima beans so far tested proved susceptible, although no other species of legumes



became infected. The disease is characterized on the leaves by more or less irregular spots with grayish centers and definitely delimited purplish borders. In early stages the disease is characterized by purplish or brown spots, with slightly depressed lower surfaces, and in late stages the center becomes gray. Petiole, stem, and pod lesions accompany the disease on the leaves. The seed was found to be attacked, and it is considered probable that the organism may live over winter in the seed. It is also believed that the organism may live over winter in bean refuse.

As a result of isolation and inoculation experiments the causal organism was determined, and it is described as *Bacterium viridifaciens* n. sp.

**Cabbage diseases**, L. L. HARTER and L. R. JONES (*U. S. Dept. Agr., Farmers' Bul. 1351* (1923), pp. 11+29, figs. 14).—This is a revision, by J. C. Walker, of Farmers' Bulletin 925 (E. S. R., 38, p. 850), in which popular descriptions are given of a number of the more important common diseases to which cabbage is subject.

**Texas root rot of cotton and methods of its control**, J. J. TAUBENHAUS and D. T. KILLOUGH (*Texas Sta. Bul. 307* (1923), pp. 3-98, figs. 15).—The results are given of six years' laboratory and field experiments on the cause of Texas root rot, life history of the organism, conditions which favor infection, methods of spread, and means of control.

This disease, by reason of the large number of economic plants attacked, is believed to be one of the most important plant diseases of the State. Studies by the authors indicate that root rot is capable of attacking 31 different economic field crops, 58 truck crops, 18 kinds of fruit and berries, 35 kinds of forest trees and shrubs, 7 kinds of herbaceous ornamentals, and 20 kinds of weeds. But little difference in resistance has been found in the various varieties of cotton. Among the apples and pears tested none showed any resistance, while peach trees and pecans were highly or wholly resistant.

The authors studied the influence of various factors on the development and control of the disease and found that it was greatly influenced by soil moisture and temperature which result in a well developed root system. Deep plowing, crop rotation, and the addition of fertilizers were not found to be of practical value in controlling the disease. Early and close planting through the tendency to cause better root contacts favored the occurrence of root rot. Some evidence was obtained that indicates there is more root rot in a cotton crop if it follows another crop of a susceptible host, such as the sweet potato.

The authors claim to have demonstrated through artificial cultures that the fungus *Ozonium omnivorum* is specifically connected with *Phymatotrichum omnivorum*, which has been previously described (E. S. R., 36, p. 146). From a study of the parasitic habit of this organism it is believed that it is unable to maintain itself on dead organic matter, but that it requires a living host on which to winter over. Cotton roots and the perennial morning-glory (*Ipomoea trichocarpa*), and perhaps other plants, serve as living hosts on which the fungus winters over.

For the control of the disease it is recommended that after the last cotton picking, cotton roots should be pulled out, exposed to drying, and then worked under. Clean cultivation, if thoroughly performed, would also reduce the tendency on the part of the fungus to spread.

**Control of cotton wilt by the use of potash fertilizers**, L. E. RAST (*Jour. Amer. Soc. Agron., 14* (1922), No. 6, pp. 222-224, figs. 3).—In 1920, nine 5-acre plats on different plantations near Scott, Ark., were experimentally planted to cotton, the soil being alluvial river land of the sort known as Lonoke very fine sandy loam. To this was added 500 lbs. per acre of a different fertilizer for each plat, but on both the fertilized fields and the unfertilized control the cotton

plants almost all died. In 1921, 1,000 lbs. was used of a fertilizer, which showed on analysis 5 per cent available phosphoric acid, 1.5 per cent nitrogen, and 6.25 per cent potash (in kainit). Applied before planting, this gave a crop showing no dead plants and weighing out 1,127 lbs. of seed cotton per acre, as against 225 lbs. from the control, on which the plants were badly infected and began to die long before they were mature. Plants on an adjoining area to which 500 lbs. per acre of fertilizer containing 10 per cent available phosphoric acid, 3 per cent nitrogen, and no potash was applied before planting and to which 500 lbs. per acre of kainit was used as an additional application after the plants were up and growing, were equally resistant to the disease and just as prolific.

These experiments will be continued, and various kinds and quantities of potash, both alone and in combination with other plant foods, will be used to determine their effectiveness in controlling this disease.

**Transmission, variation, and control of certain degeneration diseases of Irish potatoes,** E. S. SCHULTZ and D. FOLSOM (*Jour. Agr. Research* [U. S.], 25 (1923), No. 2, pp. 43-118, pls. 15).—A detailed account is given of investigations on degeneration diseases of the potato. The authors recognize the following diseases which may cause degeneration: Mild mosaic, leaf-rolling mosaic, rugose mosaic, streak, leaf roll, spindling-tuber disease, and unmottled curly dwarf.

The symptoms of each disease are described, means of transmission indicated, and the effect of each disease on a number of different varieties of potatoes is shown. It was found that a number of these diseases may occur in combination. The different diseases vary in their economic importance, and natural transmission by insects contributes to the difficulty of the control problem. Perpetuation of the diseases is said to occur in the tubers and not in the soil alone. Interspecific inoculations with leaf mutilation and aphids are said to indicate that tobacco mosaic is not identical with potato mild mosaic, that the tomato is susceptible to both of these mosaics and also to rugose mosaic, and that nightshade is susceptible to mild mosaic. Raspberry mosaic appeared harmless to potatoes.

From studies of methods of control it is claimed that selection of tubers without knowledge of the parent plants can not eliminate seed from diseased plants infected late in the season. Hill selection in fields containing diseased plants throughout the growing season was found disappointing as a means of eliminating disease. Proximity and a heavy aphid infestation were said to increase the spread of mild mosaic, while sufficient isolation from diseased stocks reduced it so that a state of freedom from the disease was maintained. Conditions that reduced aphid dispersal from diseased to healthy hills was found to reduce the amount of disease transmission.

Potato degeneration is considered largely, and possibly entirely, a result of the increase of, and injury by, certain degeneration diseases.

**Degeneracy diseases of potato,** V. DUCOMET (*Min. Agr. [France], Ann. Épiphyties*, 8 (1922), No. 3, pp. 27-93).—Of these two chapters, the first deals generally with phases of degenerescence, including their history. The second deals with selection by different plans and phases looking to prevention of degeneracy in potato varieties.

**The importation of potatoes for seed,** V. PEGLION (*Italia Agr.*, 60 (1923), No. 3, pp. 111-115).—This report, presented to the Commission for Consultation on Potato Diseases, deals with the necessity for periodical change of seed tubers, the justification and results of importation of foreign seed potatoes, and potato canker.

**Potato brown rot,** F. C. MEIER and G. K. K. LINK (*U. S. Dept. Agr., Dept. Circ.* 281 (1923), pp. 6, pls. 2).—A popular description is given of the brown



rot of potatoes due to *Bacillus solanacearum*, and suggestions are given to control the disease or prevent its spread after harvest and in storage.

**Late blight of potatoes and the weather**, W. H. MARTIN (*New Jersey Stas. Bul.* 384 (1923), pp. 5-23, figs. 2).—As a result of his investigations the author considers that there is a correlation of weather conditions with outbreaks of late blight. In those years when the July temperature was below the average (73.7° F.) for the month and the rainfall above the average (5.02 in.) epidemics of late blight were experienced. As a general deduction it is claimed that in New Jersey when the temperature for the month of July is below 74° and the rainfall above 4.74 in., conditions are produced that are likely to result in an epidemic of late blight.

**Ten years of potato spraying in New Jersey**, W. H. MARTIN (*New Jersey Stas. Bul.* 383 (1923), pp. 5-32).—A summary account is given of 10 years' work of spraying potatoes by the New Jersey Experiment Stations in which it was found that with the variety Irish Cobbler an average increase in yield of 28.2 bu. per acre was obtained due to spraying, although late blight was absent. Spraying tests with the American Giant variety in the absence of late blight did not result in increased yields, but when late blight was present an average increase of 69.4 bu. per acre was secured. Spraying tests with late crop potatoes grown for seed purposes showed an average increase of 33.2 bu. per acre, and in addition to the increased yields preliminary tests showed that tubers from sprayed plants were more vigorous than those from unsprayed ones. A 5-5-50 Bordeaux mixture proved the most satisfactory fungicide used, and comparative tests with homemade and commercial Bordeaux mixtures showed better control for the former. In general, 4 to 5 applications are recommended for the Irish Cobbler variety, while for the American Giant, a late variety, 5 to 7 applications are considered desirable.

**Effect of fertilizers and lime on control of tomato leaf spot (*Septoria lycopersici*)**, F. J. PRITCHARD and W. S. PORTE (*Phytopathology*, 11 (1921), No. 11, pp. 433-445, figs. 16).—Experiments are reported in which a number of fertilizers were tested to determine their effect on the leaf spot of tomato plants, and no fertilizer or other substance used was found to increase or decrease the susceptibility of tomato plants to leaf spot except as it affected growth or the internal conditions accompanying growth. Different quantities and ratios of sodium nitrate, potassium sulphate, acid phosphate, air-slaked lime, and copper sulphate were employed, and the different substances either increased or decreased the leaf area and thereby caused a corresponding alteration in the number of infections per plant. Favorable conditions for growth increased susceptibility to infection.

**Biochemistry of plant diseases.—III, Effect of *Sclerotinia cinerea* on plums**, J. J. WILLAMAN and W. M. SANDERSTROM (*Bot. Gaz.*, 73 (1922), No. 4, pp. 287-307, figs. 7).—The first paper in this series (E. S. R., 42, p. 758) dealt with the vitamin requirement of the fungus (*S. cinerea*), the second with its relations to the pectic substances of the host (E. S. R., 44, p. 825). The present paper deals with the composition of certain varieties of plums, and the changes in composition brought about during the process of rotting due to the fungus. The literature bearing on the chemistry of plant diseases, especially the effect of disease on the composition of plants and the chemical differences between resistant and nonresistant varieties of the same species, is reviewed in some detail.

The laboratory inoculations recorded in this paper corroborated the field observations on plum varieties as to their relative resistance to the brown rot fungus (*S. cinerea*). In the field an important factor in resistance is the thickness of the skin. In the present studies this was eliminated by

injecting the spores into the tissues, so that the differences in the rate of rotting were due mostly to physiological factors. The object of the investigation was to throw some light on these factors.

The varieties showed not only different rates of rotting, but the character of the growth of the fungus differed as to the amount of fruiting. The susceptible varieties in general showed a greater amount of fruiting on the surface of the fruits. No study is recorded in the literature of the factors affecting sporulation in this fungus, except the vitamin relations touched upon by Willaman, as above noted. In the present work it was noticed that the juices of resistant varieties have a higher specific gravity, a slightly greater H-ion concentration, a lower titratable acidity, and a slightly greater oxalic acid content. In these items the differences between resistant and nonresistant varieties are not sufficiently marked to convince one that they constitute the chemical basis of resistance. Culture work with *Sclerotinia*, using fruit juices in which the various factors can be varied and controlled, will no doubt throw considerable light on the question.

When the fungus rots the plum, some well marked changes in composition take place in the tissues. The juices show considerable decrease in specific gravity, a decrease in true acidity, a decrease in titratable acidity that is of greater magnitude than the decrease in true acidity, and an increase in oxalic acid content. The fungus in some way prevents the production of tannin that takes place in the green fruit after it is picked from the tree. The fungus converts a portion of the nonprotein nitrogen of the host into protein nitrogen in its own mycelium.

Nitrites could not be detected in any of the samples. They are probably not a product of the rotting by this fungus. No hypothesis can be suggested as yet for the chemical and physiological basis of resistance in the brown rot of stone fruits.

**Biochemistry of plant diseases.—IV, Proximate analysis of plums rotted by *Sclerotinia cinerea*, J. J. WILLAMAN and F. R. DAVISON (*Bot. Gaz.*, 74 (1922), No. 1, pp. 104–109, figs. 2).**—In the present work the ordinary proximate analyses, together with the determination of calcium, were made, using four varieties of plums at three stages of maturity.

Plum tissue that has been rotted by *S. cinerea* was found to be consistently higher in ash, CaO, nitrogen, and ether extract than is the sound tissue. This is ascribed to loss of dry matter by respiration in the rotted samples. The resistant varieties are conspicuously higher in crude fiber than the susceptible. The quality and quantity of the structural elements of the tissues no doubt are important factors in their resistance properties. The ash, nitrogen, CaO, and ether extract are lower in the resistant varieties, but not sufficiently so to constitute limiting factors in the nutrition of the invading parasite. As the ripening of plums proceeds, there is a decrease in the ash, nitrogen, and calcium content, due probably to storage of carbohydrates and acids.

**Rots of early strawberries in Florida and southern California.** N. E. STEVENS (*Amer. Jour. Bot.*, 9 (1922), No. 4, pp. 204–211, figs. 4).—*Rhizopus nigricans*, known to be the most common cause of decay of ripe strawberry fruits in Florida, is of minor importance on winter strawberries in California. *Botrytis cinerea*, which is common on strawberries only under conditions of extreme moisture in Florida, is regularly abundant in California during the winter. This difference seems to be due in part to the somewhat more favorable moisture conditions in California, but especially to the fact that during the winter months there is a daily period during which the temperature



is favorable for the growth of *B. cinerea*, but unfavorable for the growth of *R. nigricans*.

**A study of the damping-off disease of coniferous seedlings**, T. S. HANSEN, W. H. KENETY, G. H. WIGGIN, and E. C. STAKMAN (*Minnesota Sta. Tech. Bul. 15* (1923), pp. 5-28, figs. 20).—A report is given of a study of the effect of time of sowing, treatment of seed, etc., on the damping-off of coniferous seedlings.

It is claimed that to obtain rapid germination seed should not be sown until the soil temperatures reach 60° F. Seed sown early in the summer is less subject to damping-off than that sown in the early spring. Preliminary soaking of the seed of white and Norway pine does not hasten or increase the rate of germination, but it does increase the tendency to injury from damping-off. The seed should be covered as lightly as is consistent with good nursery practice. Manure was found not to increase damping-off, but tankage not only increased damping-off but decreased germination. The use of sphagnum moss as a mulch is said to increase germination and decrease damping-off with the possible exception of jack pine. The more densely seeds were sown, up to 300 per square foot, the higher the germination and the less the injury from damping-off. For the treatment of the seed beds the authors claim that for the sterilization of white pine  $\frac{1}{4}$  oz. sulphuric acid per square foot gave the best results, for Norway pine and white pine  $\frac{1}{2}$  oz. hydrochloric acid per square foot, and for jack pine  $\frac{1}{8}$  oz. hydrochloric acid. These treatments should be applied at the time of sowing, the expense of applying fungicides at other times being entirely out of proportion to the results obtained. There is said to be no great danger of loss from damping-off after the seedlings are about four weeks old.

**Fungi causing damping-off of coniferous seedlings in Minnesota**, E. C. STAKMAN (*Minnesota Sta. Tech. Bul. 15* (1923), pp. 29-35).—A study was made of the different fungi capable of causing damping-off of coniferous seedlings in Minnesota, and it was found that species of *Fusarium*, *Pythium*, *Rhizoctonia*, *Botrytis*, and possibly *Alternaria* are more or less universally in the soil and as facultative parasites may produce damping-off. No evidence was found to indicate that one host species is more susceptible than another to the same organism, and the different types of injury could not be correlated with the presence of the different kinds of fungi found in the lesions. All the organisms except *Botrytis* were found in beds that had been previously treated.

**Brown bast [and canker of Hevea]**, T. PETCH (*Arch. Rubbercult. Nederland. Indië*, 5 (1921), No. 8, pp. 446, 447).—This brief corrective discussion refers to confusion between the two diseases, Hevea brown bast and Hevea canker.

**Treatment of moldy rot disease by application of Agrisol**, A. SHARPLES (*Agr. Bul. Fed. Malay States*, 9 (1921), No. 3, pp. 184-191).—A first field test of Agrisol against rubber tree moldy rot proved successful. A second test under trying conditions, which are indicated, though less successful evidenced the value of Agrisol under field conditions, the disease being kept under control on areas where it had always previously been troublesome. The procedure of using Agrisol is simple. Other experiments with coal-tar products are contemplated.

**Ring rot, a new disease of Hevea**, P. E. KRUCHENIUS (*Arch. Rubbercult. Nederland. Indië*, 4 (1920), No. 10, pp. 495-497, pls. 3).—Hevea bark ring rot is reported as common in Sumatra and present in the Straits Settlements and the Federated Malay States. It affects the outer half of the bark, which in the initial stage of the disease is characterized by a sepia color and succulence, but later dries and scales off, mostly in concentric rings. The trouble, which ap-

pears to be due to a fungus, may disappear without treatment or may be remedied by scraping away the diseased bark.

Notes on the South American leaf disease of rubber, W. N. C. BELGRAVE (*Agr. Bul. Fed. Malay States*, 9 (1921), No. 3, pp. 179-183).—These notes are taken from a report by the author giving results of a visit made to Trinidad and British Guiana in November, 1920, for the purpose of studying the South American rubber leaf disease, the history of which is briefly outlined as showing a tendency to increase locally on the occurrence of favoring conditions. There must be almost a continuous supply of fresh young leaves for the disease to flourish. Wintering is not as sharply defined in this region as in the Federated Malay States. Reference is made to information regarding the disease, particularly as furnished by Bancroft (*E. S. R.*, 38, pp. 153, 356) and by Stahel (*E. S. R.*, 45, p. 654).

### ECONOMIC ZOOLOGY—ENTOMOLOGY.

Twenty-second report of the State entomologist of Connecticut for the year 1922, W. E. BRITTON ET AL. (*Connecticut State Sta. Bul.* 247 (1923), pp. 269-381, pls. 16, figs. 8).—Following a discussion of entomological features of 1922 (pp. 274-278), and reports of the inspection of nurseries (pp. 279-282), inspection of imported nursery stock (pp. 282-284), inspection of apiaries (pp. 284-290), and of work in suppressing the gipsy and brown-tail moths (pp. 290-326), accounts are given of Mosquito Control Work, 1922, by S. T. Sealy (pp. 326-329); Tests of Sprays to Control the San José Scale (pp. 329-331); Tests of Paradichlorobenzene as a Remedy for the Peach Borer (pp. 331, 332) and Cabbage Root Maggot Experiments (pp. 332, 333), both by M. P. Zappe; Work with the European Red Mite in 1922 (pp. 333-338), The Occurrence of Several New Spider Mites in Connecticut (pp. 338-340), and Notes on the Life History of the Spruce Mite, *Paratetranychus ununguis* (Jacobi), (pp. 340-342), all by P. Garman; Does the Corn Earworm Live Over Winter in Connecticut? (pp. 343, 344); Notes on the Egg Stage of the Euonymus Scale (pp. 344, 345); An Asiatic Beetle in Connecticut, *Anomala orientalis* Waterh. (pp. 345, 346); Nicotin Dust as a Control for the Turnip Aphid, by B. H. Walden (pp. 346, 347); The Rhododendron Borer, *Sesia rhododendri* Beut. (pp. 347-351); The Maple Borer, *Glycobius* (*Plagionotus*) *speciosus* Say (pp. 351-355); The Maple Sesian, *Synanthedon* (*Sesia*) *acerni* Clem. (pp. 355-357); The Spruce Gall Aphid, *Chermes abietis* L. (pp. 357-359); The Bronze Birch Borer, *Agrilus anxius* Gory (pp. 359-361); Control of Ant Invasions (pp. 361-367); The European Corn Borer (pp. 367-369); and Miscellaneous Insect Notes (pp. 369-378).

In the work with the European red mite, it was found that fish-oil soap, laundry soap plus sulphur, linseed oil emulsion, and lime sulphur with lead arsenate and nicotin sulphate gave control in 1922, the more effective being applied before the middle of June. Dust containing nicotin, lead arsenate, and sulphur did not control the mite effectively. Fish-oil soap is cheaper than any of the others, and fungicides can be added without making it too expensive.

Several new forms of spider mites of economic importance not hitherto known to occur in Connecticut, here noted, include *Tenuipalpus lineola* (C. & F.), *Tetranychus populi* (Koch), *Schizotetranychus schizopus* Zach., *Paratetranychus bicolor* Banks, and *Oligonychus americanus* Ew. *P. ununguis* has been observed on spruce, red pine seedlings, and cedars in Connecticut and is capable of doing much harm, especially to young trees. Its attacks cause the needles to turn brown and drop off. The author records the collection of a few adults of *Anomala orientalis* on grounds at Westville, New Haven, formerly occupied



by a nursery company. This beetle, which is a destructive pest of sugar cane in the Hawaiian Islands, could not be detected in 1922, and it is thought that the infestation may have been entirely eradicated by the removal of the nursery and the erection of buildings. The application on August 21 of a sulphur-nicotin dust containing 5 per cent of nicotin sulphate, equivalent to 2 per cent of nicotin, to rutabagas infested by *Aphis pseudobrassicæ* Davis resulted in the complete destruction of the aphids where the dust was thoroughly applied. The rhododendron borer has been a source of injury to rhododendrons in New Haven, South Manchester, and Greenwich during the past two years, and its control is a somewhat difficult problem in large plantings.

**Thirty-fifth report of the State entomologist, 1921**, E. P. FELT (N. Y. State Mus. Bul. 247-248 (1923), pp. 129, pls. 2, figs. 3).—This report gives an account of the injurious insects of the year, including the European corn borer (pp. 15-29), codling moth (with a chart and tabulation showing the effect of temperature on codling moth oviposition) (pp. 29-36), corn earworm or bollworm (pp. 37-40), raspberry beetle or raspberry byturus (*Byturus unicolor* Say) (pp. 40-42), wheat midge (pp. 43-50), Hessian fly (pp. 51-54), wheat jointworms (*Harmolita tritici* Fitch and *H. vaginicola* Doa.) (pp. 54-58), and the confused flour beetle (*Tribolium confusum* Duv.) (pp. 58-61), and notes on other insects.

**A systematic catalogue of the insects which attack plants in Brazil and an entomological bibliography**, A. DA COSTA LIMA (Arch. Escola Super. Agr. e Med. Vet. [Nichteroy, Rio de Janeiro], 6 (1922), No. 1-2 pp. 107-276).—This is an annotated list of 654 insect enemies of plants in Brazil, systematically arranged, and a bibliography of 379 titles. Alphabetical indexes to the species and genera of insects and of plants are included.

**Annual report of the assistant entomologist for the year ended June 30, 1921**, C. C. GHOSH (Burma Dept. Agr. Ann. Rpts. Agr. Stas. [etc.], 1921, pp. 72-82).—Under the heading of investigation and observations of pests, the author reports upon the principal insects of the year attacking paddy, cotton, palms, leguminous field crops, vegetables, tobacco, fruit trees, etc.

**The parasitic relations of worms and insects**, F. S. BODENHEIMER (Centbl. Bakt. [etc.], 2. Abt., 58 (1923), No. 9-12, pp. 220-242).—This is a brief summary of information taken up under the headings of cestodes; trematodes; nematodes, including the Filariidae, Anguillulidae, and Mermitidae; Nematomorpha; and Acanthocephali. A bibliography arranged by groups is included.

**A new method of making engine oil emulsions**, A. M. BURROUGHS (Missouri Sta. Bul. 205 (1923), pp. 8, figs. 4).—This bulletin presents the results of the year's work with the Missouri cold emulsions (E. S. R., 49, p. 253), and gives directions for their preparation and use. By following the method here described paraffin oils of the type used in spraying can be emulsified without heating and without the use of potash fish-oil soap.

Substances which have served to stabilize oil-soap emulsions in the presence of hard water have been used as emulsifying agents. These are freshly made Bordeaux mixture, freshly made copperas-lime mixture, calcium caseinate (Kayso), saponin, and others. The cold emulsions have proved to be as efficient as the oil-soap emulsions against the San José scale and the grain aphid. No injury to apple trees has resulted from one year's use in the dormant, delayed dormant, and cluster bud stages. The cold emulsions are somewhat cheaper and easier to prepare than the oil-soap emulsions and very much cheaper than lime sulphur and the miscible oils. They break down more easily in storage than the manufactured oil-soap emulsions, but can be reemulsified by pumping through a spray nozzle. The cold emulsions have the advantage that they do

not break down in the presence of hard water or water contaminated with lime or lime sulphur, as do the soap emulsions."

There is strong evidence that a 2 per cent oil will control San José scale, and the same may be said for the control of aphids at the delayed dormant period. It has not been shown as yet that lubricating oil emulsion can be safely applied to apple foliage, although it is probable that no serious injury would result to apple trees up to the time the blossoms appear.

**New developments in control of walnut pests,** R. E. SMITH (*Calif. Cult.*, 61 (1923), No. 2, p. 35).—The author reports having observed the dusting of 10 acres of walnuts for aphids by two men before breakfast, and later a battery of five "supergiant" sprayers covering 40 acres of walnuts per day with liquid lead arsenate-nicotin spray for control of the codling moth and aphids. The dusting was done with one of the new self-mixing type of machine, which has been described in California Experiment Station Bulletin 357 (E. S. R., 49, p. 287). In using the new machine a 50-lb. sack of hydrated lime was emptied into the hopper of the duster and 0.75 pint of 40 per cent nicotin solution poured over it, making a 1.5 per cent mixture, after which the duster was thrown into action, and the mixture was ready for application by the time the operators had taken their positions. Experiments recently conducted at Goleta, Calif., have shown that anything as expensive even as kerosene to replace part of the nicotin, as mentioned in Bulletin 357, is not necessary, but that the amount of nicotin may be cut down if the amount of moisture is kept up. Thus, in place of 2 pints of 40 per cent nicotin solution to 100 lbs. of lime, 1 pint of nicotin to 1 pint of water gave practically as good results, and even 0.5 pint of nicotin to 1.5 pints of water was very nearly as effective. Denatured alcohol as a diluent appeared to increase the effectiveness of the dust still further, possibly by aiding the volatilization of the nicotin.

**Grasshopper control in Colorado,** C. L. CORKINS (*Colorado Sta. Bul.* 287 (1923), pp. 19, figs. 17).—Brief accounts are given of the life history, habits, and control of five of the most destructive locusts in Colorado, namely, the two-striped locust (*Melanoplus bivittatus* Say), lesser migratory locust (*M. atlanis* Ril.), red-legged locust, differential locust (*M. differentialis* Uhl.), and the long-winged locust of the plains (*Dissosteira longipennis* Thom.). Four formulas are given for poison bran mash, each based on different Colorado conditions. Hopperdozers are described and illustrated, and natural control, organization for control measures, and financing a grasshopper campaign are discussed.

**Preliminary notes on two minor pests of the Egyptian cotton crop** (*Creontiades pallidus* Ramb. and *Nezara viridula* L.), T. W. KIRKPATRICK (*Egypt Min. Agr., Tech. and Sci. Serv. Bul.* 33 (1923), pp. [2]+15).—During the course of investigations of the Egyptian cottonseed bug (*Oxycarenus hyalinipennis* Costa.), two other insects came to the author's attention as being to some extent responsible for some of the damage that has hitherto been wrongly, and somewhat vaguely, attributed to *Oxycarenus*, namely, the green shield-bug (*N. viridula* L.) and a pale green capsid, *C. pallidus* Ramb. Brief accounts are here given of these insects, the nature and extent of their injury, and methods of control. Both these plant bugs feed on green bolls, and their attack may be recognized by the presence of proliferations on the inside of the carpel wall. Their attack on small bolls generally results in shedding and on larger ones in premature opening and the production of dead lint. Hand picking of *Nezara*, in the event of a bad infestation, and clean cultivation are the only feasible methods of limiting the damage of the two pests that can be suggested.



**Construction and operation of barriers against chinch bugs**, J. W. McColloch (*Kans. Agr. Col. Ext. X Form No. 202* (1923), pp. 4, fig. 1).—A brief popular account.

**The tropical bedbug in relation to the transmission of relapsing fever in Panama**, L. H. DUNN (*Amer. Jour. Trop. Med.*, 3 (1923), No. 4, pp. 345-350).—"Bedbugs that had fed on man and on rat infected with relapsing fever did not transmit it to uninfected animals by feeding on them at subsequent intervals. Bedbugs caused relapsing fever when macerated and inoculated into a white mouse as late as 32 days after they had fed on an infected animal. Spirochetes were found in the coelomic fluid of bedbugs 15 days after feeding on infected blood. This would indicate that the spirochetes survive and apparently multiply in the bugs for a while at least."

**Tobacco hornworm insecticide: Recommendations for use of powdered arsenate of lead in dark-tobacco district**, A. C. MORGAN (*U. S. Dept. Agr., Farmers' Bul. 1356* (1923), pp. II+8).—This is a revision of and supersedes Farmers' Bulletin 867 (*E. S. R.*, 38, p. 159).

**Control of the western peach and prune root-borer**, D. C. MOTE (*Oregon Sta. Circ. 50* (1923), pp. 4, figs. 3).—This circular calls attention to the fact that *Sanninoidea opalescens* Edw., which is one of the worst insect enemies of the peach and prune in Oregon, can be easily and cheaply controlled by the use of paradichlorobenzene.

**The diamond-back moth**, J. BRETHES (*An. Soc. Rural Argentina*, 57 (1923), No. 4, pp. 162-166, figs. 3).—This is a brief summary of information on this enemy of cabbage in Argentina.

**Notes on the control of cutworms by poisoned bait**, J. C. F. FRYER and R. STENTON (*Ann. Appl. Biol.*, 10 (1923), No. 2, pp. 241-252, figs. 3).—Experiments reported show that the bran bait method of dealing with cutworms is very fairly effective in the case of mangel and swede fields, one dressing destroying about 45 per cent. No substance more attractive to *Agrotis* larvæ than moist bran was found, bran being taken practically as readily as the natural food.

**Disinfecting cotton seed to prevent the spread of the pink bollworm**, R. E. McDONALD and G. J. SCHOLL (*Texas Dept. Agr. Bul. 71* (1922), pp. 38, figs. 16).—This bulletin reports upon experiments conducted with the view to determining the thermal death point of the pink bollworm and the temperature injurious to germination of the cotton seed. Many of the details are presented in tabular form. The findings have been summarized as follows:

"Cotton seed must be subjected to a higher temperature than that which is to be obtained at exit. All seed masses must be broken up and each individual seed comes into contact with the heating medium. Cotton seed uniformly heated to 145° F. with 3.5 minutes exposure will be rendered free of living pink bollworms. Cotton seed may be heated to 165° without injury to germination. Disinfecting machinery should be equipped with reliable heat control apparatus and a good recording thermometer."

**Clothes moths and their control**, E. A. BACK (*U. S. Dept. Agr., Farmers' Bul. 1353* (1923), pp. II+29, figs. 21).—This is a practical summary of information on the common species of clothes moths, including the case-making clothes moth (*Tinea pellionella* L.), the webbing clothes moth (*Tineola biselliella* Hum.), and the carpet moth, which is less frequently met with than the two first mentioned.

**The yellow fever mosquito**, L. O. HOWARD (*U. S. Dept. Agr., Farmers' Bul. 1354* (1923), pp. II+14, figs. 6).—This is a revision of and supersedes Farmers' Bulletin 547, previously noted (*E. S. R.*, 29, p. 656),

**The Hessian fly in Kansas,** J. W. MCCOLLOCH (*Kansas Sta. Tech. Bul.* 11 (1923), pp. 3-96, figs. 29).—This is an account based upon a review of the literature and investigations conducted by the author. It was prepared in 1918 and reports investigations of the Hessian fly at the station during the last Hessian fly outbreak, extending from 1912 to 1917. Many data are presented in tabular and chart form. It is pointed out that the pest now occurs in 82 counties in the State, and during the period from 1912 to 1917 its ravages on wheat caused a loss of at least \$55,000,000.

The author finds that as many as five distinct broods may be present during the year, the number varying on account of such factors as temperature and moisture. "During the period covered by this paper (1913-1917) the first and second spring broods and the main fall brood have been present each year, the midsummer brood was noted in 1915, and the supplementary fall brood in 1914, 1915, and 1916. Dry weather and low temperatures appear to be the limiting factors in the number of broods. A study of the source of the various broods indicates that the adults of any generation may be the progeny of any brood of the previous two years, that no brood is complete in itself, and that some flaxseed always hold over to later generations.

"A number of factors enter into the natural control of the fly. Some evidence is at hand to indicate that the structure of the plant has an important bearing on the successful development of the fly on the plant. Climatic conditions are also of great importance in the life economy of the fly. . . . Five parasites have been reared from flaxseed collected in the State, three species of which have been rather numerous each year. A summary of the field observations indicates that the parasites are only one factor in the biologic complex of the fly and can not be relied upon to effect a control. . . . Among the measures of control that might be recommended under certain conditions are the intermittent growing of wheat, burning of stubble, planting resistant varieties, the use of fertilizers, and rotation of crops. Each of these has some merit under exceptional conditions, but should not be advocated for general practice. A practical system of control has been developed for Kansas, based on a thorough study of the life history of the fly under various conditions encountered in the State. The important steps in this method of control are: (1) Early, deep plowing of the stubble, (2) proper preparation of the seed bed, (3) destruction of all volunteer wheat, (4) delaying the sowing until the fly-free date, and (5) cooperation."

A list is given of 33 references to the literature cited.

**Work and parasitism of the Mediterranean fruit fly in Hawaii during 1919 and 1920,** H. F. WILLARD (*Jour. Agr. Research* [U. S.], 25 (1923), No. 1, pp. 1-7).—This report of the work of determining the parasitism of the fruit fly in Hawaii, in continuation of those previously noted (E. S. R., 42, p. 654), is presented largely in tabular form. The first table records the extent of infestation of host fruits by larvae of *Ceratitis capitata* Weid. in Hawaii during 1919 and 1920, the second table the percentage of parasitism of larvae of *C. capitata* in Hawaii in 1919 and 1920, the third table the total parasitism of all larvae of *C. capitata* collected in Hawaii during 1919 and 1920 (monthly averages), and the fourth table the total parasitism of all larvae of *C. capitata* collected in Hawaii from 1915 to 1920 (yearly averages).

The observations have shown that with the Indian almond, which is found in all sections of Honolulu and is much preferred as a breeding place by the fruit fly, the average infestation in 1919 and 1920 decreased 15 and 44 per cent, respectively, over that of 1918. These are the first important decreases in infestation of preferred host fruits observed since parasitism records were



started. *Diachasma fullawayi* Silv., which prior to 1920 had a tendency to attack its host freely in only a few fruits (strawberry, guava, coffee, French cherry, and yellow oleander), in 1920 freely attacked larvae in nearly all fruits under observation, causing death in 12.1 per cent of all larvae during the year, or nearly double its percentage of parasitism during any of the previous 5 years, with the exception of 1917, when it was 7.3. *Tetrastichus giffardianus* Silv. has also shown an increase over previous years, although not so great as *D. fullawayi*. The continued activities of parasites during the past 6 or 7 years and the fact that they have destroyed approximately 50 per cent of the fruit flies developing during the past 4 years have caused a noticeable decrease in the infestation of some of the most preferred host fruits of the fly.

**Frit fly on oats in the four northern counties,** R. A. H. GRAY (*Jour. Min. Agr. [Gt. Brit.], 29 (1923), No. 12, pp. 1109-1114*).—Observations during the year are said to have shown the advantages of early sowing as a preventive of the frit fly on oats in England, and it is recommended that seed be sown in March. In places where oats have been severely injured by it, sowing in the autumn is recommended.

**Fleas of Panama, their hosts, and their importance,** L. H. DUNN (*Amer. Jour. Trop. Med., 3 (1923), No. 4, pp. 335-344*).—In this paper the author deals with *Xenopsylla cheopis* Roth., *Dermatophilus penetrans* L., *Pulex irritans* L., *Echidnophaga gallinaceous* West., *Ctenocephalus felis* Bou., *C. canis* Cur., *Rhopalopsyllus dunni* J. and R., *R. klagesi* Roth., and *R. cacicus* J. and R.

**The strawberry rootworm as an enemy of the greenhouse rose,** C. A. WEIGEL and C. F. DOUCETTE (*U. S. Dept. Agr., Farmers' Bul. 1344 (1923), pp. II+14, figs. 14*).—This is a practical summary of information on *Paria canella quadrinotata* Say and *P. canella gilvipes* Crotch, which in the last 7 or 8 years has appeared in greenhouses and been a source of injury to forced rose plants in all the commercial rose growing districts in the United States east of the Rocky Mountains. The injury is done by the larvae and adults, almost every part of the plant above ground being subject to attack by the beetles. The larvae not only devour the young tender rootlets but also girdle and gnaw into the stronger ones, even the main roots, thus interfering with the normal functioning of the root system. Cultural and control methods recommended include clean culture of the rose beds and the application of a dust consisting of 15 parts of lead arsenate or calcium arsenate and 85 parts of sulphur, after each syringing, beginning about February 15 up to the time the plants are cut back.

"Keep the bed surface covered with tobacco dust from the middle of February until the drying period, and apply wood ashes about once a month as recommended. During the drying period fumigate three or more times with hydrocyanic acid gas, the last fumigation to be given the night before the plants are cut back. Follow the workers who are cutting away the tops with another group to scrape the soil from the surface. After cleaning out all the tops and after scraping the soil, spray the stalks with lead arsenate or calcium arsenate to protect the bark and 'eyes.' Water the beds the day after cutting back, and replace the removed soil with new. As the new growth begins to develop keep it dusted continuously to prevent feeding by beetles. During September and October keep the plants very thoroughly dusted with arsenicals, because during these months the beetles are emerging and feeding voraciously, and the chances of poisoning them at this time are very good. During these two months apply two or three kerosene nicotine oleate treatments at times when the beds are watered heavily." Preventive measures are also considered.



**Fumigation of potting soil with carbon disulphid for the control of the Japanese beetle (*Popillia japonica* Newm.),** W. E. FLEMING (*New Jersey Stats. Bul.* 380 (1923), pp. 5-45, figs. 7).—The investigations here reported, presented in large part in chart and tabular forms, show carbon disulphid to be a cheap and efficient material for fumigating potting soil to free it of infestation by the Japanese beetle larvæ. The investigations are reported under the headings of dose of carbon disulphid lethal to the Japanese beetle larva, the dosage and its application in the fumigation box, chemical study of the diffusion of carbon disulphid vapor in the soil, the relation of the fumigation chamber to the efficiency of the dose, and the effect of carbon disulphid on subsequent plant growth.

Tests made in 500- and 950-cc. containers show the minimum lethal dosage in air and relatively dry soil when the temperature is above 50° F. and the exposure is from 24 to 48 hours to be 0.04 gm. per liter. Soil-air moisture does not affect the minimum lethal dose to any appreciable extent. The efficiency of the minimum lethal dose varies directly with the temperature, being noneffective below 50° and, inversely with the soil moisture, being noneffective in wet soil. The work with the fumigation box showed that carbon disulphid must be placed in the soil to kill all the larvæ. It is considered advisable to use not less than 13 fluid ounces (1 lb.) to a cubic yard of soil with an exposure of 48 hours at a temperature above 50°, experiments having shown that this dosage destroys the egg and pupa as well.

"Dosage holes must be arranged so that the diffusion regions from the various injection holes overlap and thus assure all parts of the soil being treated. It is suggested that when 18 in. of soil have been placed in the fumigation box, injection holes should be made 6 in. deep, from 12 to 15 in. apart, and 12 to 15 in. distant in the rows, with 1.5 oz. of CS<sub>2</sub> in each injection hole. After closing the hole 18 in. more soil are placed in the box, and the process is repeated until the box is filled."

Observations on the diffusion of carbon disulphid vapors in the soil show that "concentration of the gas varies directly with the depth from the surface of the soil and inversely with the distance laterally from the injection hole. Maximum concentration is attained sooner and disappears more quickly from the layers of soil relatively near the surface. Lateral diffusion of the gas varies directly (according to Marion) with the atmospheric temperatures, but is independent, generally speaking, of the atmospheric pressure. Diffusion in a wet soil varies inversely with the soil moisture. A wet soil should not be treated. Soil type has little effect on the diffusion of the gas when the soil is placed loosely in the fumigation chamber. The soil takes up or absorbs a considerable amount of the initial carbon disulphid charge, after which it removes little from the soil air. Retreating the soil greatly increases the persistence of the vapors in the soil."

A list is given of 77 references to the literature.

**Carpet beetles and their control,** E. A. BACK (*U. S. Dept. Agr., Farmers' Bul.* 1346 (1923), pp. II+14, figs. 13).—Accounts are given of the common carpet beetle, the black carpet beetle (*Attagenus piceus* Oliv.), the varied carpet beetle (*Anthrenus verbasci* L.), and the furniture carpet beetle (*A. fasciatus* Herbst.) and means for their control.

**The tobacco flea-beetle in the southern cigar-wrapper district,** F. S. CHAMBERLIN and J. N. TENHET (*U. S. Dept. Agr., Farmers' Bul.* 1352 (1923), pp. II+10, figs. 8).—This is a practical summary of information on *Epitrix parvula* Fab. as an enemy of cigar-wrapper tobacco grown in northern Florida and southern Georgia and means for its control.



**The control of shot-hole borer in tea by the use of general manures,** C. H. GADD and N. K. JARDINE (*Trop. Agr. [Ceylon]*, 60 (1923), No. 5, pp. 299-304).—This is a preliminary report in which conclusions are tentatively offered.

**The Australian tomato weevil introduced in the South: A preliminary account,** F. H. CHITTENDEN (*U. S. Dept. Agr., Dept. Circ.* 282 (1923), pp. 8, figs. 6).—This is a summary of information of the present status of knowledge of this curculionid, accounts of the occurrence of which in Mississippi by Bynum have been previously noted (*E. S. R.*, 49, p. 761).

**Three little-known clover insects,** J. D. DETWILER (*New York Cornell Sta. Bul.* 420 (1923), pp. 28, figs. 24).—The author reports upon studies, largely biological, of three clover pests, namely, the clover head weevil, *Phytonomus neles* Fab. (pp. 3-13), the lesser clover leaf weevil, *P. nigrirostris* Fab. (pp. 13-20), and the clover seed weevil, *Tychius picrostris* Fab. (pp. 20-27). A preliminary account by Herrick and Detwiler has been noted (*E. S. R.*, 41, p. 251).

**The turnip gall weevil, *Ceuthorrhynchus pleurostigma* Marsh, I-III,** P. V. ISAAC (*Ann. Appl. Biol.*, 10 (1923), No. 2, pp. 151-193, pls. 3, figs. 31).—The first part of this paper (pp. 151-170) deals with the life history and bionomics of *C. pleurostigma*, the second part (pp. 171-189) with the larval anatomy, and the third part (pp. 190-193) with control measures.

There are said to be two distinct races of this insect, a spring race which breeds in *Sinapis arvensis* and not at all in cultivated crucifers, and a summer race which breeds in *Brassica campestris* and *B. oleracea*. Its natural enemies include the common slug *Limax maxima*, the larva of a hydrophilid (*Helophorus rugosus*), and a braconid parasite (*Diospilus oleraceus*). Cultural methods, which form the principal means of control, include the rooting out and burning of all overwintered infested stalks before the larvæ leave the galls, plowing immediately following the removal of the crop, rotation of crops, and destruction of all charlock and hedge mustard, on the foliage and flowers of which the adult beetles feed.

**Further notes on *Pempheres affinis* Fst. (the cotton stem weevil),** E. BALLARD (*India Dept. Agr. Mem., Ent. Ser.*, 7 (1923), No. 12, pp. 243-255, pls. 1, figs. 2).—This is a report of studies of a weevil that has attained some notoriety in South India as a pest of exotic and indigenous cotton. This weevil, however, is not one of the major pests of cotton.

**A few hypotheses on white pine losses from weevil damage,** P. COVILLE (*Ames Forester*, 11 (1923), pp. 72-80, figs. 4).—This is a report of studies of the work of *Pissodes strobi*, made with the view to showing that there is a factor other than the loss in merchantability of the lumber due to crooked poles after injury, namely, the loss in merchantable length due to a loss in vitality brought about by the weevil.

**Dust-poison method for control of boll weevil,** F. SHERMAN and W. B. LABEE (*N. C. Agr. Col. Ext. Circ.* 127 (1923), pp. 22, figs. 4).—This presents a discussion of operations in North Carolina in 1922, when upward of 50 farmers dusted with calcium arsenate. The testimony of the farmers is reported, together with a summary of the chief difficulties met. The paper also includes discussion of cotton-dusting machinery, etc.

**Forty-third annual report of the Beekeepers' Association of the Province of Ontario, 1922** (*Ontario Dept. Agr., Beekeepers' Assoc. Ann. Rpt.*, 1922, pp. 96).—The proceedings of the annual meeting are here presented.

**On the biology of *Bephrata cubensis* Ashm., which attacks the fruit of nonaceae,** S. C. BRUNER and J. ACUÑA (*Rev. Agr., Com. y Trab. [Cuba]*, 6 (1923), No. 7, pp. 21-30, figs. 14).—This is a report of observations made in



1922 of the biology of the seed-infesting chalcid *B. cubensis*, which causes the fruit of custard apples in Cuba, particularly *Anona squamosa* and *A. reticulata*, to decay. The pest, which is widely distributed in Cuba, has recently been found by Moznette attacking custard apples (*A. glabra*) in Miami, Fla.

**Platygaster vernalis Myers, an important parasite of the Hessian fly,** C. C. HILL (*Jour. Agr. Research* [U. S.], 25 (1923), No. 1, pp. 31-42, pls. 4, figs. 7).—This is an account of the parasite that is more effective than any other species attacking the spring generation of the Hessian fly in the Middle Atlantic States. Records kept of 18,656 puparia examined show a percentage of 23.89 killed by this parasite. The details of biological studies of *P. vernalis*, of its seasonal history, and certain ecological considerations are reported. The observations made from 1918 to 1921 have led to the following conclusions:

"During each year the death rate of *P. vernalis* was very high, being not less than 81.33 per cent for any one year, and in 1920 being as high as 96.08 per cent. A large percentage of the mortality of *P. vernalis* was due to competition with other Hessian fly parasites. During the years 1918, 1920, and 1921 for the localities under observation, *P. vernalis* was more effective than all other parasites of the spring generation of the Hessian fly combined. It should be stated that, although the attacks of the other parasites are highly detrimental to the multiplication of *P. vernalis*, yet they supplement the latter sufficiently well to effect a very high death rate of the Hessian fly. They also act as a safeguard in case of scarcity of *P. vernalis*. In all cases, moreover, the hyperparasitism appears to be entirely accidental. It would therefore be unwise to discount too greatly the value of the other parasites."

**An annotated list of Ichneumonidae in the Pusa collection,** G. R. DUTT (*India Dept. Agr. Mem., Ent. Ser.*, 8 (1923), No. 2, pp. 13-27, pl. 1).—This annotated list includes a description of one species new to science.

## FOODS—HUMAN NUTRITION.

**Foods and drugs,** J. M. BARTLETT (*Maine Sta. Off. Insp.* 107 (1923), pp. 8).—This is the annual tabulation of the results of the examination of food and drug samples collected by the inspectors of the division of inspections of the State department of agriculture.

**Milk and its uses in the home** (*U. S. Dept. Agr., Farmers' Bul.* 1359 (1923), pp. II+20, figs. 2).—This publication is a revision of and supersedes Farmers' Bulletin 1207 (*E. S. R.*, 46, p. 60).

**Inactive malic acid as a food acidulent,** J. M. WEISS, C. R. DOWNS, and H. P. CORSON (*Indus. and Engin. Chem.*, 15 (1923), No. 6, pp. 628-630).—The suitability of inactive malic acid for use as a food acidulent was tested by a study of the relative toxicity for rabbits of varying amounts of the acid in question and of other substances in common use for such purposes, including citric, lactic, tartaric, phosphoric, and natural malic acids, sodium sulphate, and sodium chlorid. Fumaric acid and its sodium salt were also included on account of the fact that *i*-malic acid usually contains small quantities of fumaric acid. Rabbits were used as the experimental animals and were given the material in solution or suspension through a stomach sound, observations being made hourly for 24 hours.

The estimated initial minimum fatal dose of the various substances in grams per kilogram of body weight were citric acid 7, tartaric 5, *i*-malic 7+, *l*-malic 5.5, fumaric 5+, lactic 5, and phosphoric acid 3.5 (?) gm. Tests with small amounts of *i*-malic, citric, and tartaric acids administered daily showed no cumulative toxic action and no acquired tolerance for larger doses.

**Electric cooking,** A. M. LLOYD (*Hotel Mo.*, 31 (1923), No. 362, pp. 45, 46, 48).—The use of electricity in commercial cooking is discussed.



**Preventive infant feeding.** H. J. GERSTENBERGER (*Amer. Jour. Pub. Health*, 13 (1923), No. 3, pp. 185-195).—In this paper, read before the child hygiene section of the American Public Health Association at its fifty-first annual meeting in Cleveland, Ohio, October 16, 1922, historical and other information is summarized, and the qualifications necessarily required of an artificial method of feeding to make it a successful means of preventing nutritional disturbances, such as malnutrition, are outlined and discussed, as follows: "A, The food must be complete; B, it must be simple, (1) for preparation by the parent, (2) for prescribing by the family physician; C, its cost must be within the reach of the big middle class; D, it must be free from pathogenic bacteria; E, it must keep."

**Biological food tests.**—I, II, A. F. MORGAN (*Amer. Jour. Physiol.*, 64 (1923), No. 3, pp. 522-546, figs. 2).—Two papers are given.

I. *Vitamin A in some citrus fruit products* (pp. 522-537).—The technique employed by the author in determining the vitamin A content of foods is described in detail, and the results are reported of a series of tests undertaken to determine the value of orange, lemon, and grapefruit juice, oil, and skin as sources of vitamin A.

The basal diet for the experimental rats consisted of casein purified by heating in thin layers for 24 hours at 130° C. 18, agar 2, salts 4, dextrin prepared by heating cornstarch at 170 to 180° for from 5 to 7 hours 56, and fat 20 per cent. When the diet was to be free from vitamin A, Crisco was used as the fat and 0.3 gm. of dried brewery yeast as the source of vitamin B. If the diet was to furnish vitamin A, 10 parts of butterfat was substituted for an equal amount of Crisco. The plan of the experiment included both curative and preventive tests with young animals.

Among the various orange products were four preparations of the oil of orange peel. The first, an ether extract, was found to be very effective as a source of vitamin A, doses as small as 0.1 gm. daily proving sufficient to cure xerophthalmia and promote growth in rats stunted by a deficiency of vitamin A. The second oil, prepared by cold pressure from young navel oranges, afforded protection in 0.2 gm. amounts daily. The third oil, prepared by cold extraction from overripe Valencia oranges which had been allowed to stand on the trees until somewhat desiccated, proved ineffective as a source of vitamin A in any dosage which could be administered. The failure of this product is attributed to loss of vitamin A through oxidation. The fourth oil, obtained by steam distillation, had no appreciable amount of vitamin A. It is of interest that the four oils used varied in depth of orange color in the same order as in vitamin A efficiency, and that a colorless lemon oil prepared from fresh whole lemons by the same method as those yielding active products in the case of orange oils was ineffective as a source of vitamin A.

Dried orange peel from which the inner white coat had been removed was effective in curing xerophthalmia and promoting growth in doses of between 0.5 and 1 gm. daily and dried lemon peel not quite so effective in 1 gm. doses. Grapefruit peel proved ineffective in the two cases in which it was tried.

Of a concentrated orange juice prepared by evaporating fresh juice under reduced pressure to one-sixth its original volume, 2 cc. was the minimum amount effecting a cure of xerophthalmia.

II. *Vitamin A in skim milk* (pp. 538-546).—Using the same experimental methods as in the previous study, the author has attempted to determine the distribution of vitamin A in the aqueous and fatty portions of milk. Both prophylactic and curative methods were employed. In the former 14 young rats were placed on the usual vitamin A-free basal diet, supplemented by varying proportions of a commercial skim milk powder prepared by the spray process.



In the latter 8 young rats were kept on the vitamin A-deficient diet to the point of decline in weight and development of xerophthalmia, and were then given dried skim milk in daily portions of 5 gm. mixed with 20 per cent of Crisco.

In the first series, the addition of 15 per cent of skim milk did not prevent loss in weight and in some cases the development of eye symptoms. On increasing the amount to 25 per cent and finally giving 5 gm. of the powder daily the loss in weight was checked, but there was no gain until after the diet had been supplemented with butterfat.

In the curative experiments an immediate improvement was noted in the eye condition, gain in weight, and general state of nutrition following the administration of the skim milk. This improvement continued for from 3 to 17 weeks, but in no case proved permanent, decline in weight and death ensuing unless the skim milk was supplemented by some other source of vitamin A.

"Quantities as large as 5 gm. of the dried skim milk were found to be less effective than 0.25 gm. of butterfat of the same origin. The proportion of vitamin A in dried skim milk and butterfat would appear, therefore, to be less than 1:20, in fresh skim milk and butterfat less than 1:220, and average whole milk should be more than eight times more valuable as a source of vitamin A than the skim milk made from it."

**Experiments on vitamin A, H. C. SHERMAN and M. M. KRAMER** (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 4, pp. 201, 202).—The conclusions drawn from a study of the question of the storage of vitamin A in the body are summarized briefly. It is stated that even at the weaning age of four weeks young rats may already have a considerable but varying content of vitamin A, depending upon the content of this vitamin in the mother's diet. This is shown by the different growth curves and survival periods of young animals of different litters when placed on the deficient diet. Evidence that the body can store vitamin A at later ages is furnished in a comparison of the survival period of two male rats of the same litter and of the same weight at four weeks of age which were placed on diets furnishing different amounts of vitamin A until growth was completed, and then placed upon the same experimental diet deficient in vitamin A. The survival period of the animal which, during growth, had received the diet much richer in vitamin A was nearly twice as long as that of the other animal.

It is also stated that rats of the same litter growing to adult size on the same diet show strikingly uniform survival periods when placed at the same age on diets deficient in vitamin A.

**The cause of reproductive upset in dietary deficiencies due to lack of vitamin A, H. M. EVANS and K. S. BISHOP** (*Abs. in Anat. Rec.*, 25 (1923), No. 3, p. 129).—As the result of several hundred experimental matings of rats, the females of which were maintained on diets deficient in vitamin A, the authors conclude that the reproductive disorder due to a deficiency in vitamin A is different from that due to the lack of the unknown factor previously noted (E. S. R., 48, p. 864), in that in the present case failure of reproduction is caused by the impairment of germ cell vigor by a selective ovarian in contrast to uterine disorder.

**On the incidence of keratomalacia among rats suffering from avitaminosis, A. D. STAMMERS** (*So. African Jour. Sci.*, 19 (1922), pp. 241-243).—In view of the discrepancy in the reports of other investigators concerning the extent of ophthalmia in experimental animals on diets deficient in vitamin A, the author reports the incidence of this eye trouble among 100 rats suffering from varying degrees of deficiency in vitamin A. Of these 44 were fed a fat from



which vitamin A had been removed by steam distillation (E. S. R., 46, p. 256) and the remaining 56 upon fats of varying degrees of deficiency.

Of the first group 40 were from 33 to 49 days old at the beginning of the experiment, and of these 35 developed ophthalmia between the thirty-first and eightieth day. The other 4, which were 145 days old at the beginning of the experiment, all developed ophthalmia between the one hundred and fourth and one hundred and twenty-ninth day of the experiment. Of the 56 animals on the partially deficient diet, 24 developed ophthalmia between the thirty-fifth and ninety-eighth day.

**The effect of ultraviolet rays on rats deprived of vitamin A in their diet,** O. SHEETS and C. FUNK (*Soc. Expt. Biol. and Med. Proc.*, 20 (1922), No. 2, pp. 80, 81).—To determine the effect of ultraviolet light on growth and on xerophthalmia, two lots of 6 young rats each were placed on a vitamin A deficient diet. One lot was exposed to the action of a carbon arc lamp for 5 minutes daily for 3 weeks and for the remainder of the time for 3 minutes daily except Sunday to ultraviolet light. Tables are given showing the initial weight of the animals on February 2, the final weight on June 17, and the length of time before the appearance of xerophthalmia.

Three of the controls not receiving the light treatment developed xerophthalmia in 129, 134, and 137 days, respectively, and 3 of the rayed animals at 128, 128, and 140 days. None of the animals developed rickets, and there was no difference in the growth rate of the two series.

**The influence of light and darkness upon the development of xerophthalmia in the rat,** G. F. POWERS, E. A. PARK, and N. SIMMONDS (*Soc. Expt. Biol. and Med. Proc.*, 20 (1922), No. 2, pp. 81–84).—This is a brief report of an investigation undertaken to determine whether or not direct sunlight and radiation with a mercury vapor quartz lamp have a similar preventive and curative action for xerophthalmia as for experimental rickets in rats. The general scheme of the investigation was to subject comparable groups of rats on the same deficient diets, one deficient in phosphorus and vitamin A and another in vitamin A alone, to different conditions of light, (1) ordinary room light, (2) ordinary room light plus ultraviolet lamp radiation (30 minutes exposure per day), and (3) direct sunlight in the open air (average exposure 4 hours per day).

On both diets the rats in the first three groups developed xerophthalmia early in the experiment, while those exposed to direct sunlight did not until after the death of the animals in the other group. In some of these animals xerophthalmia developed late in the experiment and in a severe form, in others it occurred in a mild form with spontaneous recovery, and in 2 it did not develop at all during the light treatment. In general there was a prompt development of xerophthalmia after the sunlight treatment had been stopped.

On the diet deficient in both phosphorus and vitamin A, the animals subjected to ultraviolet lamp radiation and to sunlight did not develop rickets, while those in ordinary room light and in darkness did. The difference with respect to the effect of ultraviolet light is considered to furnish evidence that the favorable effect of sunlight on xerophthalmia is not so much due to its furnishing "a specific preventive factor as in improving cellular function, with the result that the animals yield slowly, if at all, to the development of the malady."

**The influence of radiant energy upon the development of xerophthalmia in rats: A remarkable demonstration of the beneficial influence of sunlight and out-of-door air upon the organism,** G. F. POWERS, E. A. PARK, and N. SIMMONDS (*Jour. Biol. Chem.*, 55 (1923), No. 4, pp. 575–597, figs. 2).—This is the complete report, with experimental data, of the investigation noted above.



**Effect of autoclaving on vitamin content in milk**, E. J. SLANETZ (*Jour. Dairy Sci.*, 6 (1923), No. 3, pp. 237-242, figs. 5).—Milk was autoclaved at 10 or 15 lbs. pressure for 15 minutes and fed to two groups of growing mice which had been kept for 15 or 16 days on diets deficient in vitamin B and in vitamin A, respectively. In both cases a rapid rise in the weight curves resulted, showing that no appreciable destruction of vitamins had occurred.

**Contribution to the study of avitaminosis B in the pigeon**, J. LOPEZ-LOMBA and RANDOIN (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 18, pp. 1249-1251, fig. 1).—In the study reported the following diet was used: Casein deprived of vitamin B by prolonged washing with 0.2 per cent acetic acid 18, butterfat 10, peanut oil 6, pure rice starch 54, sugar 4, filter paper 4, and artificial protein-free milk 4 per cent. This mixture, when made into pellets and dried in the oven, is said to have an energy value of about 400 calories per 100 gm. It is stated that at the beginning of the experiment the pigeons voluntarily consume from 38 to 40 gm. of the diet, but after about two weeks the appetite diminishes and it is necessary to feed them forcibly. In this way at least 20 gm. can be administered a day.

In about 65 per cent of the cases the complete syndrome of polyneuritis is produced by this diet, in 20 per cent there is paralysis and nerve symptoms without convulsions, in 5 per cent death occurs suddenly between the ninth and fifteenth day, and in 10 per cent there are no other symptoms than drowsiness and extreme weakness from about the eighth day. The survival period is from 28 to 50 days.

In comparing the weight of various organs of pigeons on this diet with those of controls which had received yeast, the following observations are reported: There was a loss in body weight of from 30 to 35 per cent of the initial weight. Calculated per kilogram of original body weight, the kidneys showed a 10 per cent and the adrenals a 48 per cent increase in weight. There was no alteration in the weight of the heart, brain, and lungs. The testicles, pancreas, and thyroid showed a loss in weight of 15, 24, and 28 per cent, respectively, the liver and the spleen showed a loss in weight of about 45 per cent, and the thymus entirely disappeared.

**Changes in the weight of the organs of the pigeon in the course of avitaminosis B**, J. LOPEZ-LOMBA (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 20, pp. 1417-1419, fig. 1).—An extension of the above study is reported in which 36 pigeons were given the basal diet supplemented in 6 cases only by 1 gm. of dry yeast daily. The 6 controls were killed at the end of 6, 17, 21, 22, 27, and 30 days, respectively, and the remaining 30 killed 1 each day. A certain number of the organs were weighed, the weights calculated per kilogram of the original body weight, and the figures thus obtained plotted against the time in days. In discussing the curves obtained, the time is divided into four periods—the period of incubation covering the first nine days, from the ninth to the fourteenth, from the fourteenth to the twenty-third, and from the twenty-third to the thirtieth day.

There was practically no change in the weight of the kidneys or brain during the entire period and but slight change in the first period in the heart, liver, and testicles. Toward the end of the first period there was a gain in weight in the pancreas and a loss followed by a gain in most of the other organs. In the second period the thyroid, heart, spleen, and thymus hypertrophied, and the adrenals and pancreas atrophied. In the third period the thyroid returned to practically normal weight and the adrenals to slightly above normal, while the testicles underwent marked hypertrophy. In the final period the adrenals underwent a sharp hypertrophy, the pancreas continued to lose weight, and the heart and thyroid also decreased in weight.



These results are thought to indicate that the lesions and disturbances of avitaminosis B are due particularly to functional disturbances of the neuro-endocrine system.

**On the basal metabolism in vitamin B starvation and in beriberi**, S. OKADA, E. SAKURAI, T. IBUKI, and H. KABESHIMA (*Japan Med. World*, 3 (1923), No. 5, pp. 102-104).—The authors report a study of the basal metabolism of normal subjects and subjects with mild beriberi on diets deficient in vitamin B and on the same diets supplemented by oryzanin as a source of vitamin B. The apparatus and technique of Boothby and Sandiford were used throughout.

In 7 of the 10 cases examined, the basal metabolism decreased during vitamin B starvation and rapidly resumed its normal value following the administration of oryzanin. This fall in metabolism could be noted before any evidence of change of appetite, food consumption, and body weight. Of the 28 cases of beriberi examined the basal metabolism was normal in over 80 per cent. A lowering in the basal metabolism was usually accompanied by paralysis. This is thought to indicate that beriberi is not due entirely to vitamin B starvation.

**The etiology and pathology of rickets from an experimental point of view**, V. KORENCHEVSKY ([*Gt. Brit.*] *Med. Research Council, Spec. Rpt. Ser.*, No. 71 (1922), pp. 172, pls. 18, fig. 1).—This monograph includes a critical and exhaustive review of the literature on experimental rickets and the complete report of the author's own investigations on the subject, some of which have been noted from other sources (*E. S. R.*, 48, p. 466). The conclusions concerning the etiology of rickets are as follows:

"The question of the heredity of rickets can not be finally settled at present. On the basis of clinical, pathologico-anatomical, and experimental investigations it is impossible to deny the existence of a congenital disease of the skeleton—if not of a rachitic character, at any rate predisposing to rickets. The presence or deficiency of antirachitic factor and calcium salts in the mother's diet during conception, pregnancy, and lactation control, to a considerable extent, not only the general nutrition of the offspring, but particularly its skeletal development and the eventuality of the appearance of rickets. Some clinical observations point to the possible significance of the state of the father's health for the normal development of the skeleton of the offspring. The attention of mothers should be specially drawn to the necessity for the presence of a sufficient amount of antirachitic factor, phosphates, and calcium salts in their diet during pregnancy and lactation."

An extensive bibliography and a series of photographs and photomicrographs are appended.

**The effect of sunlight upon the concentration of calcium and of inorganic phosphorus of the serum of rachitic children**, B. KRAMER and F. H. BOONE (*Soc. Expt. Biol. and Med. Proc.*, 20 (1922), No. 2, pp. 87-89).—A brief report is given of a study of the effect of direct sunlight on the rachitic changes in the bones of children and on the calcium and inorganic phosphorus concentration in their blood. To determine whether pigmented skin interferes with the therapeutic action of the sun's rays, seven negro babies of varying degrees of pigmentation and all suffering from active rickets were used as subjects. The children were fed on milk dilutions and orange juice and exposed to direct sunlight, beginning with periods of 15 minutes, then 30 minutes, and finally 1 hour daily.

Definite evidence of healing could be demonstrated in all cases by means of the radiogram during the third week of treatment, the extent of pigmentation apparently not interfering with the beneficial action of the sun's rays. A marked change in the concentration of the organic phosphorus in the blood occurred within 14 days, and the amount reached normal values within 3



weeks. It is concluded that the action of sunlight is even more prompt than that of other curative agents for rickets.

**Studies in experimental scurvy, with special reference to the anti-scorbutic properties of some South African foodstuffs**, E. M. DELF (*So. African Inst. Med. Research, Pubs. No. 14* (1921), pp. 105, pl. 1, figs. 12).—This is the complete report of an investigation which has been noted previously from another source (*E. S. R.*, 47, p. 568).

**The identification of *Bacillus botulinus* and its toxin in culture and in canned foodstuffs by serological methods**, R. A. KELSER (*Amer. Jour. Pub. Health*, 13 (1923), No. 5, pp. 366–376).—"The experiments detailed in this paper demonstrate the value of the complement-fixation test in identifying whole bouillon cultures of *B. botulinus*, Berkefeld filtrates of both pure and contaminated cultures, saline suspensions of the toxin-free spores, and then in the case of canned foodstuffs the value of the test in demonstrating *B. botulinus* and its toxin in such products as asparagus, spinach, corn, string beans, and sausage."

**An outbreak of food poisoning traced to the consumption of egg salad**, C.-E. A. WINSLOW, I. V. HISCOCK, O. F. ROGERS, and E. S. ROBINSON (*Amer. Jour. Hyg.*, 3 (1923), No. 3, pp. 238–246).—An account is given of the symptomatology, bacteriology, and epidemiology of an outbreak of food poisoning occurring among members of an eating club at Yale University in November, 1922, and involving 51 cases, but with no fatalities. The source of infection was found to be an egg salad which was evidently contaminated with organisms of the paratyphoid type.

## ANIMAL PRODUCTION.

**Ensiling v. drying soft ear corn**, J. M. EVVARD, A. R. LAMB, and E. J. MAYNARD (*Iowa Sta. Bul.* 216 (1923), pp. 402–432, figs. 3).—This is the report of an experiment in comparing two methods of preserving soft ear corn. In making this study the soft ear corn was graded into four grades, A, B, C, and D, depending largely on maturity and freedom from mold. Samples from each group were then ensiled in March, 1918, the cutter being so set as to cut the ears in from  $\frac{1}{4}$  to  $\frac{1}{2}$  in. lengths. Sufficient water was added to make the silage contain about 60 per cent moisture. Samples of grade B and C ears were artificially dried at a temperature of from 115 to 120° F, in a constant draft of air. The composition of the soft corn of the different grades before and after ensiling and drying is given in tabular form, as well as studies of the dry matter and nutrients in the different samples before and after storage.

When the silos were opened in November, 1918, it was apparent that normal fermentation had gone on and good types of silage were produced in the three most mature grades, but the most immature ears produced a soft mushy silage having a musty odor. Both types of dried ear corn were in good condition. The relative costs of ensiling and drying corn per 100 lbs. were, respectively, 13 and 21 cts.

**Growth-promoting value of the proteins of the palm kernel, and the vitamin content of palm kernel meal**, A. J. FINKS and D. B. JONES (*Jour. Agr. Research* [U. S.], 25 (1923), No. 4, pp. 165–169, figs. 5).—A study of the quality of the proteins and the vitamin A and B content of palm kernel meal by feeding experiments with rats at the Bureau of Chemistry, U. S. D. A., has indicated that adequate proteins for growth are furnished when palm kernel meal makes up 80 per cent of the ration; the other constituents being salt 4 per cent and Crisco 16 per cent, with small amounts of yeast and cod-liver oil. Four other feeding experiments indicated that the palm kernel meal contains some vitamin A and vitamin B, but not sufficient B to produce normal growth



nor sufficient A to prevent xerophthalmia when the palm kernel meal made up either 25 or 40 per cent of the ration, although better growth was maintained and over a longer period in each case when the ration contained 40 per cent of the palm kernel meal.

**The enforcement of the Kansas feeding stuffs law,** L. A. FITZ and A. E. LANGWORTHY (*Kansas Sta. Insp. Circs. 14 (1921), pp. 223; 19 (1922), pp. 181*).—These publications define the more common feeding stuffs and explains the operation of the Kansas feeding stuffs law. The composition of the samples of the feeds officially analyzed, as collected from July 1, 1918, to July 1, 1920, are also given in the first circular, and that of samples collected for the following biennium in the second.

**Cattle feeding investigations, 1921–22,** C. W. McCAMPBELL, H. B. WINCHESTER, and H. W. MARSTON (*Kansas Sta. Circ. 97 (1923), pp. 8, fig. 1*).—Two feeding experiments carried on during 1921–22 are briefly reported.

**The maximum utilization of silage in fattening baby beef.**—Six lots of 10 calves each averaging about 370 lbs. in weight were selected to compare different methods of feeding silage and corn for baby beef production, in continuation of the experiments previously noted (E. S. R., 46, p. 366). All lots received cane silage ad libitum and an average of about 2 lbs. of alfalfa hay and 1.72 lbs. of cottonseed meal per head daily for the entire period of 195 days. Lots 1, 2, and 3 received full feeds throughout the test of cane seed and yellow and white shelled corn, respectively. In lots 4, 5, and 6 white shelled corn was full fed after the first 60, 90, and 120 days in the respective lots. The average daily gains of lots 1, 2, and 3 were 1.92, 1.98, and 1.9 lbs., respectively, indicating that there was little difference in the gains which could be made with cane seed or yellow and white corn, but it required considerably more cane seed to produce 100 lbs. of gain. The rate of gain in lots 4, 5, and 6 was slower and they were made less economically than in lots 2 and 3. This confirms previous years' results, that when corn is cheap it is more economical to full feed it throughout the feeding period to baby bees, but when corn is high more economical results are obtained by full feeding silage during the first part of the feeding period.

**The effect of wintering cattle on alfalfa and on silage upon summer pasture gains.**—The results of this experiment have been more fully reported from another source (E. S. R., 49, p. 167).

**Feeding cottonseed meal to steers on grass,** E. BARNETT and C. J. GOODELL (*Mississippi Sta. Circ. 50 (1923), pp. 3*).—The results of an experiment carried on in 1917 to study the advisability of feeding cottonseed meal to steers on pasture is reported. One lot of 12 steers averaging about 630 lbs. received in addition to the run of a pasture 3 lbs. of cottonseed meal per day for the first 56 days, 5 lbs. for the next 28 days, and 6 lbs. for the last 28 days. Another lot received no feed other than pasture for 112 days. In both lots the pasture was principally Bermuda grass, though there was some clover and paspalum. The pasture was much better in the lot which did not receive cottonseed meal. The average daily gains made were 2.83 and 2.4 lbs., respectively, with and without the cottonseed meal supplement. Those receiving the cottonseed meal shrank about 5 per cent, whereas those not receiving cottonseed meal shrank about 7 per cent in transit to market. The finish was also slightly better for the lot receiving cottonseed meal, though those receiving pasture only showed a greater profit.

**Lamb feeding experiments,** J. L. LANTOW and M. G. SNELL (*New Mexico Sta. Bul. 138 (1923), pp. 12*).—The results of two lamb feeding experiments are reported. In the first trial 4 lots aggregating 170 lambs were grazed for 30 days on cornstalks and weeds beginning December 14, 1916, during which time



they only gained 0.06 lb. per day. This was followed by a 60-day feeding period during which the lots 1, 2, and 3 received daily rations per lamb of alfalfa hay and 1 lb. of corn. The alfalfa was chopped for lot 2 and corn silage was given in addition to lot 3. Lot 4 received daily 1.6 lbs. of corn, with corn silage and alfalfa hay. The average daily gains made by the 4 lots during the 6-day feeding period were 0.4, 0.44, 0.39, and 0.38 lb., respectively. A brief report of this test was previously noted (E. S. R., 38, p. 672).

Comparisons were made during 1921 and 1922 of the profits accruing from feeding common and good feeder lambs. The feeds used in both years consisted of corn and alfalfa hay. In 1921 there were 100 lambs in each lot, the good ones averaging 55.19 lbs. and the poor ones 40.02 lbs. Each lot made average daily gains of 0.24 lbs. The common lambs were penalized 2 cts. per pound at selling time, which resulted in a calculated loss of 27 cts. per head, as compared with the profit of \$1.17 per head by the good lambs.

In the second test the lambs were graded and then grazed together for 10 days on Bermuda grass, followed by 16 days on oat stubble and Johnson grass, and 53 days on alfalfa stubble. The good lambs gained an average of 16 lbs. and the common lambs 17 lbs. during the 84-day grazing period. A feeding period of 81 days followed the grazing period, during which the good lambs made average daily gains of 0.3 lb., consuming 260 lbs. of corn and 704 lbs. of alfalfa hay per 100 lbs. of gain, whereas the common lambs made average daily gains of 0.29 lb. and consumed 242 lbs. of corn and 684 lbs. of alfalfa per 100 lbs. of gain. The profits were 29 cts. per head for the good lambs and \$1.08 for the common lambs over all costs. The results indicate that good grade lambs are more profitable when feed and pasture are high, but when the lambs can be pastured for a time and feeds are cheaper common lambs may prove more profitable.

**Fattening lambs on alfalfa**, E. L. POTTER and H. K. DEAN (*Oregon Sta. Bul.* 198 (1923), pp. 16, figs. 4).—A discussion of the best types of feeder lambs, the necessary equipment for lamb feeding, length of feeding periods, and the amounts of hay to feed is followed by the results of experiments dealing with grain and silage feeding (E. S. R., 46, p. 170).

In a test at the Umatilla Branch Station 4 lots of lambs weighing about 50 lbs. each, receiving average daily rations of 2.13 to 2.42 lbs. of alfalfa hay and 0.95 lb. of grain per head, made average daily gains as follows when the different grains were fed: Corn 0.366, wheat 0.348, oats 0.332, and barley 0.334 lb. A discussion of marketing lambs is given, and the profits to be expected when feeds and lambs are at varying prices are tabulated.

**Grain sorghums v. corn for fattening lambs**, J. M. JONES and R. E. DICKSON (*Texas Sta. Bul.* 306 (1923), pp. 5-32).—In continuation of the tests with grain sorghums for fattening lambs (E. S. R., 47, p. 473), a 105-day feeding test carried on in 1921-22 with 10 lots of 20 lambs each averaging about 55 lbs. in weight is reported. All lambs received an average of 0.948 lb. of grain and 0.139 lb. of cottonseed meal per head daily, as well as equal amounts of roughage consisting of sorghum and alfalfa hay, but different proportions of the hay were wasted in the various lots. The average daily gains made by the lambs and the calculated feed costs per 100 lbs. of gain when the following grains were fed were, ground shelled corn 0.355 lb. and \$11.45, ground threshed milo 0.351 lb. and \$9.49, whole threshed milo 0.332 lb. and \$9.77, ground milo heads 0.317 lb. and \$9.65, ground threshed feterita 0.332 lb. and \$9.95, ground feterita heads 0.309 lb. and \$9.92, ground threshed kafir 0.352 and \$9.51, ground kafir heads 0.298 lb. and \$10.34, ground threshed darso 0.334 lb. and \$9.96, and threshed sorgo 0.326 lb. and \$10.26.



The results of the test indicate that the lots fattened on the threshed grain sorghums except sorgo compared very favorably with the lot fed on shelled corn. Ground threshed milo and kafir both had practically the same value as corn for producing gains, and the gains in all lots were made at less cost than with corn. Similar results were obtained when the data from the 3 years' trials were averaged. Fraps' productive values were calculated for the gains.

**The northern pig—its breeding and management,** J. H. SHEPPERD (*North Dakota Sta. Bul. 167 (1923), pp. 3-51, figs. 13*).—The principles of care, management, and feeding of breeding stock are discussed in a popular manner, and the results of a trial in hogging off corn, in continuation of the trials previously noted (*E. S. R., 47, p. 670*), are also given. The hogs, averaging about 150 lbs. in weight, were divided into 4 lots of 12 each. All lots received 3.6 acres of corn (estimated yield 177 bu.) and mineral supplements of soft coal and salt. Protein supplements in the form of alfalfa and tankage were also supplied to 3 of the lots. The following total gains were made on the different rations: Corn alone 1,239 lbs., corn with  $\frac{1}{2}$  acre of alfalfa pasture 1,408 lbs., corn and 0.4 lb. of tankage per head daily 1,477 lbs., and corn and tankage self-fed (0.83 lb. per head daily) 1,641 lbs. The rooting of the pigs on corn alone and with alfalfa indicated a deficiency in the diet.

**Swine feeding investigations, 1921-22,** F. W. BELL, H. B. WINCHESTER, and H. W. MARSTON (*Kansas Sta. Circ. 98 (1923), pp. 11, figs. 2*).—The results of four feeding experiments are briefly reported as for previous years (*E. S. R., 45, p. 575*).

*Utilization of alfalfa pasture in fattening hogs for market.*—To study the best methods of feeding pigs on alfalfa, 4 lots of 8 pigs each averaging about 39 lbs. in weight were selected and fed for 180 days on alfalfa pasture. A grain ration consisting of shelled corn, wheat shorts, and tankage was fed to lots 1 and 2 throughout the test in addition to the pasture. Lot 1 received the grain in a self-feeder, whereas the same amount was hand-fed to lot 2. Lots 3 and 4 were hand-fed one-half the amount of grain given to lots 1 and 2 for the first 60 and 120 days, respectively, of the test, followed by full feeding in both lots on self-feeders to the completion of the test. The lots 1, 2, 3, and 4 made average daily gains, respectively, of 1.57, 1.48, 1.36, and 1.21 lbs. and required 421, 444, 413, and 396 lbs. of feed, respectively, to produce 100 lbs. of gain.

The results indicate that neither market weight nor desirable finish can be secured as quickly on alfalfa pasture with limited grain feeding as when grain is full fed.

*Feeding period necessary to fatten hogs on alfalfa pasture.*—In determining the time necessary to fatten hogs on alfalfa in the above experiment, the hogs in lots 1 and 2 were found to be ready for market in 120 days, whereas those in lot 3 required 150 days and in lot 4, 180 days to produce the proper finish. Less feed was also required to produce 100 lbs. of gain in the full fed lots.

*Corn v. cane seed for fattening pigs.*—To compare cane seed and corn for fattening pigs 4 lots of 8 pigs each averaging about 66 lbs. in weight were fed for 120 days on equal amounts of whole cane seed, ground cane seed, shelled white corn, and shelled yellow corn, respectively. The same amount of a tankage supplement was also fed to each lot. The average daily gains and amounts of feed required to produce 100 lbs. of gain on the different rations were whole cane seed 0.8 and 606 lbs., ground cane seed 0.92 and 528, shelled white corn 1.16 and 418, and shelled yellow corn 1.19 and 408 lbs. The lots receiving cane seed were not properly finished at the end of the test, but they did not have all the feed that they would eat during the test.



*Alfalfa v. Sudan grass as a pasture in maintaining brood sows.*—One lot of 5 brood sows running on Sudan grass pasture from July 1 to August 30 was compared with a similar lot of sows on alfalfa pasture. Small amounts of corn were supplied in addition to the pasture, as well as 0.25 lb. of tankage per head during the last 30 days. Both types of pasture were found satisfactory, and approximately equal results were shown by each. The sows on the alfalfa pasture lost an average of 4.66 lbs. and those on the Sudan grass pasture 11.6 lbs.

*Grazing and feeding trials with hogs,* E. BARNETT and C. J. GOODELL (*Mississippi Sta. Bul. 218 (1923), pp. 32, fig. 1*).—The results of feeding experiments and grazing trials with hogs, carried on at this station from 1917 to 1923, are briefly summarized.

*Soy beans and corn.*—Noted on page 70 as Circular 49.

*Cowpeas grazed.*—In 1917, 8 Duroc-Jersey shoters averaging 126.75 lbs. were pastured on cowpeas, having a rank growth but little fruit, for 28 days. During this time they made average daily gains of only 0.17 lb. In 1918, 10 shoters averaging 111.5 lbs. were pastured for 36 days on cowpeas which contained a good crop of fruit, about two-thirds of which were mature. Average daily gains of 1.1 lbs. were made by this lot.

*Peanuts.*—Pigs, averaging 12 in number and from 100 to 125 lbs. in weight, grazing from 35 to 40 days on peanuts produced an average of 347.8, 187.16, and 134.32 lbs. of pork per acre in 1919, 1921, and 1922, respectively. The stand in the last two years was only about 50 per cent normal. In 1920, 2 lots of 8 pigs averaging 47 lbs. in weight were grazed on comparable areas of peanuts for 28 days, but one lot had access to a self-feeder containing a mixture of 2 parts of corn to 1 part of cottonseed meal. The average daily gains made by these pigs were 1.47 and 1.29 lbs. with and without cottonseed meal, respectively. By the former lot 79 lbs. of corn and cottonseed meal were consumed per 100 lbs. of gain.

*Velvet bean grazing for fattening hogs.*—A hog grazing experiment with velvet beans was carried on in 1917-18. Four lots of 6 pigs averaging about 125 lbs. each were pastured as follows: Lot 1 on 1.25 acres of velvet beans grown alone; lot 2, 1 acre of velvet beans grown with corn, but having the corn harvested before grazing; lot 3, 1 acre of velvet beans grown with corn, but having the corn harvested and hand-fed to the pigs; and lot 4, 1 acre of velvet beans and corn grown and grazed together. The respective grazing periods were 57, 70, 90, and 81 days, and the average daily gains made during this time were 0.61, 0.41, 1.04, and 0.92 lbs. The following amounts of pork were produced per acre in the respective lots: 168, 174, 560, and 446 lbs.

*Velvet beans fed in a dry lot.*—An experiment to study the feeding value of velvet beans in different combinations for hogs in dry lot was carried on in 1917-18 with 12 lots of 5 pigs each averaging about 100 lbs. in weight. The feeding period lasted 84 days. The rations fed, with the average daily gains and feed consumed per 100 lbs. of gain, were velvet beans in the pod ad libitum 0.32 and 1,117 lbs.; velvet bean and pod meal self-fed 0.002 and 15,418 lbs.; threshed velvet beans self-fed 0.4 and 767 lbs.; shelled corn self-fed 0.79 and 491 lbs.; velvet beans in pod and cottonseed meal 8:2 for 56 days, velvet beans in pod and tankage 9:1 for 28 days 0:37 and 1,098 lbs.; velvet beans and pod meal and cottonseed meal 8:2 for 56 days and velvet bean and pod meal and tankage 9:1 for 28 days 0.27 and 1,082 lbs.; threshed velvet beans and cottonseed meal 8:2 for 56 days and threshed velvet beans and tankage 9:1 for 28 days 0.31 and 887 lbs.; shelled corn and cottonseed meal 8:2 for 56 days and shelled corn and tankage 9:1 for 28 days 0.67 and 704 lbs.; velvet bean and pod and shelled corn 2:3 ad libitum 0.76 and 699 lbs.; velvet bean and pod meal and



shelled corn 2:3 ad libitum 0.58 and 902 lbs.; threshed velvet beans and shelled corn 2:3 ad libitum 0.42 and 878 lbs.; and shelled corn and cottonseed meal self-fed for 56 days and shelled corn and tankage for 28 days 0.96 and 494 lbs. The velvet beans in the pod proved more palatable than the ground bean and pod meal or shelled beans alone.

*Protein supplements with corn for fattening hogs.*—In comparing the efficiency of different protein supplements to corn for fattening hogs, 8 lots of 5 pigs each averaging about 100 lbs. were selected for an 84-day test in 1918-19. The average daily gains and feed required to produce 100 lbs. of gain when the protein supplements were self-fed as follows were with no supplement 1.04 and 511 lbs., alfalfa hay 1.37 and 479 lbs., alfalfa meal 1.46 and 473 lbs., soy beans 1.62 and 453 lbs., peanut meal 1.62 and 432 lbs., shrimp bran 1.74 and 445 lbs., and tankage 1.77 and 413 lbs. Another lot in which the supplement consisted of cottonseed meal for the first 28 days, followed by tankage for 28 days and cottonseed meal again for the last 28 days made average daily gains of 1.9 lbs. and required 442 lbs. of feed to produce 100 lbs. of gain.

*Corn and cottonseed meal.*—Three hogs averaging 215 lbs. in weight were fed for 28 days on a mixture of 2 parts of corn to 1 part of cottonseed meal and made average daily gains of 1.67 lbs. in a test conducted in 1921-22.

*Blackstrap molasses fed with corn, shorts, and tankage.*—An experiment dealing with the feeding value of blackstrap molasses was conducted in 1919 with 3 lots of 5 hogs each averaging 160 lbs. in weight. The basal ration fed consisted of corn, shorts, and tankage in a ratio of 5:5:1. Average daily gains of 1.12 lbs. were made during the 51-day test on this ration. In two other lots 3 and 4.5 parts of molasses replaced 2 and 3 parts of the corn, respectively, in the basal ration, average daily gains of 0.98 and 1.08 lbs. per hog being made on these rations.

*Corn and tankage v. rice polish and tankage for fattening fall pigs.*—The comparison of corn and tankage with rice polish and tankage previously noted (E. S. R., 49, p. 469) is again described, as well as another experiment carried on in 1923 in which 2 lots of 19 pigs each averaging 55 lbs. received these feeds in separate self-feeders. Each lot was also allowed the run of an oat pasture. During the first 8 weeks on these rations, the corn and tankage lot had gained an average of 1.24 lbs. per day, whereas the other lot had only gained an average of 0.4 lb. per day. Corn was then substituted for the rice polish and better gains were made.

*Brewers' rice.*—A single 6 weeks' trial in 1922-23 with 6 hogs averaging 181.7 lbs. indicated that brewers rice has a high feeding value. The hogs, receiving the rice in a self-feeder, made average daily gains of 2.17 lbs., requiring 418.4 lbs. of rice to produce 100 lbs. of gain.

*Feeding garbage to hogs.*—The results of an experiment in 1918-19 in which 3 lots of pigs were fed on garbage with and without the addition of limited or full feeds of a mixture of corn and tankage 9:1 are reported. Two lots receiving garbage only made average daily gains of 1.35 and 1.18 lbs. Two lots receiving garbage and 2 per cent rations of the grain gained an average of 1.42 and 1.26 lbs., and other lots receiving a one-half full ration of garbage and the grain ration in a self-feeder gained 1.55 and 1.48 lbs. A check lot receiving corn and tankage in a self-feeder made an average daily gain of 1.61 lbs.

*Corn and tankage fed in dry lots.*—This summary of the feeding trials at the station in which corn and tankage have been fed to hogs tends to show that this ration is one of the most economical combinations that has been found.

**Corn and soy beans for pork production**, E. BARNETT and C. J. GOODELL (*Mississippi Sta. Circ. 49* (1923), pp. 7).—The results of tests carried on from 1917 to 1922 in studying the gains made by hogs on soy beans when receiving different amounts of corn are reported in detail. Five different methods of grazing the soy beans were employed, (1) growing and grazing soy beans alone; (2) growing soy beans with corn, but gathering the corn before the beans were grazed; (3) growing soy beans with corn, gathering the corn, and supplementing the grazing with a small amount of corn hand-fed; (4) growing soy beans with corn, harvesting the corn, and supplementing the grazing with a medium amount of corn hand-fed; and (5) growing and grazing soy beans and corn together.

The results indicate that it is more economical to grow the soy beans and corn together, but the corn should be harvested separately and hand-fed to the pigs to produce the largest and most efficient gains. The amount of corn to feed depends on the best time for marketing, the most rapid gains being made when a 1.75 to 2.5 per cent ration was fed daily. Pigs weighing from 100 to 130 lbs. made the best use of soy beans.

**Swine feeding experiments** (*Texas Sta. Bul. 305* (1923), pp. 5-41, figs. 2).—The results of five feeding experiments are reported in this bulletin.

**Three methods of pig raising**, G. R. Warren (pp. 9-18).—In this test 3 Duroc sows with 8 pigs each were self-fed on different rations consisting of milo chop alone in dry lot, 9 parts of milo chop to 1 part of tankage in dry lot, and the latter ration with Sudan grass and oat pasture. The pigs were weaned at 75 days of age, after which they were continued to 245 days of age on the same rations except for the pigs receiving milo alone. These pigs only averaged 20.69 lbs. at weaning time and, therefore, one-half of them were given the milo chop and tankage ration with pasture to 245 days of age, during which time they made average daily gains of over 1 lb., whereas of the pigs left on the milo ration 1 died soon after weaning and the other 3 did not quite maintain weight.

The lot on milo chop and tankage in dry lot averaged 26.79 lbs. at weaning and 157 lbs. at 243 days of age. The pigs receiving pasture throughout averaged 41.38 lbs. per pig at weaning time and 249 lbs. at 245 days of age. These results have been previously referred to (E. S. R., 49, p. 469).

**Dried buttermilk for growing pigs**, D. W. Williams and Warren (pp. 19-22).—In studying the feeding value of dried buttermilk, 5 lots of 12 pigs each were hand-fed in dry lot for 155 days, beginning at weaning time, on rations containing milo chop as the basis, with different proteins supplied to the various lots in sufficient amounts to make the nutritive ratio of the ration in each case 1:4.4 at the start, which was later widened to 1:5.7. The average daily gain made with the different protein supplements fed were tankage, 0.66; dried buttermilk, 0.69; shorts and tankage, 0.65; shorts and dried buttermilk, 0.69; and shorts, tankage, and dried buttermilk 0.71 lb.

**Cottonseed and cottonseed meal as supplements to milo chops for fattening pigs**, Warren and D. W. Williams (pp. 25-27).—Four lots of 10 pigs averaging about 65 lbs. were used in a test to compare cottonseed, cottonseed meal, and tankage as protein supplements to milo chop. The average daily gains made when the following amounts of the protein supplements were fed with parts of milo chop were 1 part cottonseed meal, 0.86; 0.6 part of tankage, 1.13; and 0.5 part of cottonseed meal and 0.3 part of tankage, 0.99 lb. The cottonseed meal ration was not as well eaten as the other rations, and 1 pig died on the seventieth day apparently from cottonseed meal poisoning. These results have been briefly noted (E. S. R., 49, p. 469). Another lot receiving



parts of milo chop, 2 parts of whole cottonseed, and 0.3 part of tankage was discontinued because the pigs lost weight and would not eat the cottonseed.

*Peanut grazing and self-feeders for fattening pigs*, Warren (pp. 28-35).—A 57-day feeding test with 5 lots of 10 pigs each averaging about 119 lbs. was carried on in 1921. The average daily gains made by the pigs in the different lots with the following methods of feeding were, grazing on peanuts, 1.61; corn chop and tankage in separate self-feeders in dry lot, 2.06; milo chop and cottonseed meal in separate self-feeders in dry lot, 1.52; milo chop and peanut meal in separate self-feeders, 1.5; and grazing on peanuts for 30 days, followed by dry lot feeding by hand of 6 parts of milo and 1 part of cottonseed meal, 1.55 lbs. Only very small amounts of the cottonseed meal and the peanut meal were consumed from the self-feeders

The carcasses of all pigs grazed for the entire period on peanuts were soft; as well as the carcasses of 3 of those grazed for 30 days on peanuts. The melting points of the leaf and back fats of these carcasses were also lowered.

*Protein supplements in fattening rations for pigs*, Warren (pp. 36-41).—In comparing protein supplements for fattening hogs, 6 lots of 10 pigs averaging about 94 lbs. were selected and hand-fed for 85 days on the following rations: lot 1 corn chop and tankage (9:1), lot 2 milo chop and tankage (9:1), lot 3 milo chop and cottonseed meal (6:1), lot 4 milo chop and wheat shorts (4:1), lot 5 rice bran, milo chop, and cottonseed meal (5:4:1), and lot 6 rice bran, milo chop and peanut meal (5:4:1). The average daily gains made by the respective lots were 1.21, 1.24, 1.25, 1.08, 1.1, and 1.11 lbs. The pigs each received an average of 4.8 lbs. of grain per day.

The results indicated that rice bran and wheat shorts were rather bulky for fattening hogs. After slaughter 8 carcasses from lot 5 and 8 from lot 6 were slightly soft. The lowest average melting point of the back fat was in lot 6 and the highest in lot 3.

**Kansas State Livestock Registry Board**, F. W. BELL ET AL. (*Kansas Sta. Insp. Circ. 13* (1920), pp. 119, figs. 4).—This publication gives similar information for 1920 to that given in the preceding report for 1919 (E. S. R., 43, p. 674). Several popular articles on horse production are also included.

**Mule production**, J. O. WILLIAMS (*U. S. Dept. Agr., Farmers' Bul. 1341* (1923), pp. 11+28, figs. 24).—This discusses the production of mules with regard to the selection and management of the jacks and mares. Directions for judging mules and descriptions of the market classes are also given.

**Influence of rations fed to growing chickens on the characteristics of the adult females**, H. ATWOOD (*West Virginia Sta. Bul. 179* (1923), pp. 39, figs. 15).—The study previously noted (E. S. R., 48, p. 476) is reported in detail, with additional results of the second year's egg production of the tested birds and the first year's production of their daughters when receiving similar rations. The chicks used for the study were pedigreed and all but full sisters were removed at 20 weeks of age. Both lots had received the same grains and cabbage or sprouted oats from hatching time, but one lot (A) received a liberal supply of skim milk, whereas in the other lot (B) the amount was limited. After the first egg was laid the sisters were placed together and received like care and feed.

Trap nest records of their egg production were kept, the average weekly feed consumption and weights of the chicks, age of laying first egg by each of the 27 pullets on the liberal skim milk ration and the 28 pullets on the limited skim milk ration, individual monthly weights of the pullets, and average monthly egg production and egg weights. Similar data were presented for

these birds during their second year and for the first year's production of their daughters raised on the rations which their dams received. The lot receiving the limited amount of skim milk ate less grain and gained so slowly that the amount of skim milk was increased after 15 weeks of feeding. Some of the more interesting data reported for each group are given in the following table:

Effect of liberal and limited feeding of skim milk to growing chicks on the adult females.

Lot.	Weight per 100 chicks at 13 weeks of age.	Dead chicks 2 to 17 weeks.	Averages for pullet year.			Average for second year.		Average for pullet year of daughters.		
			Age at first laying.	Weight on Jan. 22, 1921.	Eggs produced to Dec. 1, 1921.	Averages of weights for October, November, and December, 1922.	Egg production.	Age at first laying.	Weight on Dec. 1.	Egg production.
A...	Lbs. 151.4	No. 18	Days. 179 +1.9	Lbs. 2.97	149.3+4.2	Lbs. 3.53+0.05	151.22+3.9	Days. 197.8+3.7	Lbs. 3.58	141.54+6.1
B...	52.6	34	199.4+3.8	2.07	115.6+4.8	3.28+ .04	148.41+2.4	228.5+1.7	3.26	120.83+3.4

Correlation coefficients were calculated as follows for the pullet year: Age of laying first egg with pullet weight on January 22, 1921,  $-0.72\pm0.05$  and egg production and average weight  $+0.63\pm0.06$ . The second generation birds presented four classes, i. e., the well-fed and poorly-fed daughters of well-fed and poorly-fed birds. Practically no effect was noticeable in the egg production of the daughters as a result of the feeding which the dams had received. The data also indicate that the birds beginning to lay first laid more eggs during their pullet year.

**Pedigree, the basis of selecting breeding males for egg production,** F. A. HAYS and R. SANBORN (*Massachusetts Sta. Bul.* 215 (1923), pp. 41-51, figs. 3).—Based on the results of the improvement which has been brought about in the station flock by 9 years' pedigree selection (*E. S. R.*, 48, p. 574), the authors discuss the importance of the egg records of the 31 dams in the five ancestral generations of the males as an aid in selecting males. The average of the first year's production of the daughters may also be used where such records are available. The results of this study indicate that it is equally as important to select females that will transmit high egg producing qualities as it is to select females.

**Some lessons from production records,** G. W. HERVEY (*New Jersey Stat. Hints to Poultrymen*, 12 (1923), No. 1, pp. 4).—The trap nest records of 417 White Leghorns that completed two years in the Vineland egg-laying contest have been studied, and it is shown that the second year's production is usually much lower during the winter, but more nearly equal through the spring, summer, and fall to the first year's production. The records also show the necessity for high winter, summer, and fall production for the hens to produce 200 eggs in a year. Points in favor of keeping trap nest records are enumerated, and evidence is presented to show that it is as important to consider the production of the male ancestor as it is to consider the dam's production.

**Standard varieties of chickens.**—I, **The American class,** R. R. SLOCUM, rev. by A. R. LEE (*U. S. Dept. Agr., Farmers' Bul.* 1347 (1923), pp. 11+18, figs. 15).—This is a revision of *Farmers' Bulletin* 806 (*E. S. R.*, 37, p. 368). In addition to the breeds previously noted, the following are also described: Rhode Island White, Jersey Black Giant, and Chantecler,



**Organizing a poultry plant**, G. G. SAWYER (*New Jersey Stas. Hints to Poultrymen*, 11 (1923), No. 12, pp. 4, fig. 1).—A discussion of the facts to be considered in establishing a poultry plant is given, dealing with the selection of the farm type of land, buildings, etc. Several possible lines of poultry production are also suggested.

**Turkey management**, W. F. SCHOPPE (*Montana Sta. Circ.* 115 (1923), pp. 23, figs. 5).—This circular gives a popular discussion of the best methods of care, management, breeding, and feeding turkeys and poults. Directions are also given for dressing and preparing birds for market.

## DAIRY FARMING—DAIRYING.

**Partial list of publications on dairying issued in the United States, 1900 to June, 1923**, compiled by C. B. SHERFY (*U. S. Dept. Agr., Library, Bibliog. Contrib.* 6 (1923), pp. 236).—This consists of a list of the publications on dairying which have been issued by the State experiment stations and the U. S. Department of Agriculture from 1900 to June, 1923, inclusive. A list of books which have been issued or revised since 1908 is also given, as well as the names, addresses, and cost of dairy periodicals published in the United States. A subject list is appended.

**Feeding and management of the dairy herd**, W. B. NEVENS (*Illinois Sta. Circ.* 272 (1923), pp. 3-47, figs. 11).—A description of the methods of feeding and management of the dairy herd is given, with a brief discussion of the more common diseases of dairy cattle.

**Soy bean v. alfalfa hay for milk production**, E. L. ANTHONY and H. O. HENDERSON (*West Virginia Sta. Bul.* 181 (1923), pp. 10, fig. 1).—In two experiments at this station soy bean hay has been compared with alfalfa hay for milk production. In each experiment 2 lots of 5 cows each were fed by the double reversal method for 3-week periods, with preliminary periods of 1 week each when the rations were changed. A basal ration consisting of 30 lbs. of silage to each 1,000 lbs. of live weight was fed throughout, and a grain mixture was fed at the rate of 1 lb. of grain for each 3.5 lbs. of milk produced. In addition 10 lbs. of alfalfa or soy bean hay were fed per animal daily. In each trial the cattle designated as lot 1 were fed alfalfa hay in the first period and soy bean hay in the second period, whereas lot 2 was fed soy bean hay in the first period and alfalfa hay in the second.

In the first experiment lot 1 produced 2,685 lbs. of milk and 102 lbs. of butterfat on the alfalfa ration and 2,596 lbs. of milk and 104 lbs. of butterfat when soy bean hay was fed. Lot 2 produced 3,015 lbs. of milk and 106 lbs. of butterfat when soy bean hay was fed and 2,888 lbs. of milk and 106 lbs. of butterfat during the alfalfa hay period. Lot 1 gained an average of 12 lbs. in live weight on alfalfa hay and 85 lbs. on soy bean hay, whereas lot 2 lost 95 lbs. on soy bean hay and 17 lbs. on alfalfa hay.

In the second experiment, during the first period lot 1 produced 2,900 lbs. of milk and 102 lbs. of fat, whereas lot 2 produced 3,302 lbs. of milk and 116 lbs. of fat. In the second feeding period lot 1 produced 2,803 lbs. of milk and 99 lbs. of fat, whereas lot 2 produced 3,179 lbs. of milk and 110 lbs. of fat. Lot 1 lost 57 lbs. in live weight during the alfalfa period but gained 115 lbs. during the soy bean period, whereas lot 2 gained 45 lbs. during the soy bean period and 40 lbs. during the alfalfa period. The combined results of the two trials indicate that soy bean hay is slightly superior to alfalfa hay for milk and fat production and maintenance of weight.

**Velvet beans for dairy cows**, J. P. LAMASTER and I. R. JONES (*South Carolina Sta. Bul.* 216 (1923), pp. 16, figs. 4).—This bulletin deals with tests of the



feeding value of ground velvet beans and pods and compares different methods of feeding velvet beans to dairy cattle.

*Tests to determine the feeding value of velvet bean feed.*—The results of two feeding experiments in which velvet beans were used to supplement rations of corn meal, cottonseed meal, and wheat bran are reported. The first experiment was carried on while the cows were on pasture, and the results have been briefly noted from another source (E. S. R., 48, p. 670).

The second experiment was conducted in the winter of 1922-23 with two groups of 8 cows each. The grain ration for one group consisted of cottonseed meal, wheat bran, and corn meal (1:2:2), while the other group received as much of the same mixture with an equal amount of ground velvet beans and pods added. Both groups received equal amounts of silage and hay. The feeding period lasted 9 weeks, the first week's results not being included in the average. The cows receiving the velvet bean ration produced 10,694 lbs. of milk and 467 lbs. of fat, whereas the other group produced a total of 10,627 lbs. of milk and 438 lbs. of fat. The cows on the velvet bean ration lost 165 lbs. in weight, whereas the others gained 71 lbs. In calculating the returns on a milk or fat basis, the greater profits were shown over feed costs in the lots receiving velvet bean feed. The palatability of the beans when consisting of over 50 per cent of the ration was not so good as might be desired, however.

*A comparison of the methods of feeding velvet beans.*—Two tests of the palatability of velvet beans when differently prepared for feeding indicated that ground or boiled beans were most palatable, followed by soaked beans. Whole beans were least palatable.

*Studies in milk secretion.*—XIV, The effect of age on the milk yields and butterfat percentages of Guernsey Advanced Registry cattle, J. W. GOWEN (*Maine Sta. Bul. 311 (1923), pp. 9-20, figs. 2*).—In continuing this series of studies (E. S. R., 49, p. 174), the author has reported a statistical investigation of the effect of age on milk yield and butterfat percentage in 10,644 Guernsey Advanced Registry records.

The mean, standard deviation, and coefficient of variation of the milk yields were, respectively,  $9,255 \pm 15$ ,  $2,255 \pm 10$ , and  $24.4 \pm 0.1$  per cent. The like constants for age were  $4.31 \pm 0.01$  years,  $2.21 \pm 0.01$  years, and  $51.3 \pm 0.3$  per cent. The constants for butterfat percentage were mean  $5.04 \pm 0.003$  per cent, standard deviation  $0.481 \pm 0.002$ , and coefficient of variation  $9.5 \pm 0.1$  per cent. The coefficient of correlation between the age and milk yield for these records was  $0.412 \pm 0.005$ , and the correlation coefficient between age and butterfat percentage was  $-0.116 \pm 0.006$ .

As in the study of the effect of age on the milk yield and butterfat percentage in Holstein records previously noted (E. S. R., 44, p. 675), the relation of the milk yield to age was graphically demonstrated by means of a curve. The equation describing this relationship was

$$\text{Mean milk yield} = 6,372.6 + 827.9a - 51.8a^2 + 1,394.6 \log (a - 1.25)$$

in which  $a$  is the age in years. The age of the maximum yield, as determined by this equation, was 8 years 9.24 months. The butterfat percentage, as indicated by the data, seemed to decline uniformly though slightly with age. The equation for showing this decline was

$$\text{Butterfat percentage} = 5.147 - 0.025 \text{ age.}$$

A table is also presented by which the calculated milk production and fat percentage at 8 years of age may be determined when the production at other ages is known. The results of this study are discussed with reference to Advanced Registry requirements.



**Relation between percentage fat content and yield of milk.—Correction of milk yield for fat content, W. L. GAINES and F. A. DAVIDSON (*Illinois Sta. Bul. 245* (1923), pp. 577-621, figs. 11).**—In studying the relation between the fat percentage of milk and milk yield, the authors formulated the following hypothesis: "The milk yield of cows with varying fat percentages is such that the total energy value of the milk is constant if the effects of all factors other than composition are equalized." The relation between the fat percentage and milk yields is shown in correlation tables to be universally negative when the data were taken from 23,302 records of purebred and grade Holsteins and purebred and grade Jerseys in cow-testing associations in Illinois and of purebred cattle tested and reported by the Holstein-Friesian Association, the American Jersey Cattle Club, the American Guernsey Cattle Club, the Ayrshire Breeders' Association, and the Brown-Swiss Breeders' Association. The Holstein and Jersey records were both long time and 7 days in length, and the long time records of the Holsteins were divided into those reported in volumes 18 to 24 and 24 to 30 of the Holstein-Friesian Advanced Register.

Tables and graphs are also given, showing the corresponding milk yields calculated for these data both from a fitted curve of constant energy and a fitted logarithmic curve. The deviations from the observed occurring in each case are also given and the errors calculated. In determining the energy value of the milk, the percentage of solids not fat was based on the fat content and constants for the energy of the fat and solids not fat were employed. The fitted curves and their errors tend to bear out the soundness of the hypothesis suggested by the authors in all groups of records except in those of the Holstein-Friesian long time records reported in volumes 24 to 30 of the Holstein-Friesian Advanced Register.

In comparing the milk records of different cows on the basis of this hypothesis, the milk records would be corrected for the influence of fat content to 4 per cent milk as an average for all breeds. The formula for making this correction, based on the above results, would be  $F C M = 0.4M + 15F$ , in which  $F C M$  denotes the pounds of milk corrected to a 4 per cent fat content,  $M$  is the actual milk yield, and  $F$  is the actual fat yield. The authors show how this method of comparison may be modified to compare records of cows of different breeds and to calculate the relative cost of producing milk containing different amounts of fat.

**Pasteurization of market milk in the glass enameled tank and in the bottle, T. H. WRIGHT, JR. (*South Dakota Sta. Bul. 203* (1923), pp. 3-19).**—The bacterial counts, cream line, and flavor and odor of samples of milk pasteurized in glass enameled tanks and in the bottles were compared in two series of tests. The milk was clarified in all cases and run into a glass enameled tank, after which part of it was bottled for pasteurization in the bottles, whereas the remainder was pasteurized in the tank at from 142 to 145° F. The bottled milk was surrounded by water, heated to 150° by steam, and after pasteurization it was cooled to 50° in the first part of the test and in the latter part to only 60° by cold water. After cooling the bottles were packed in ice. The tank-pasteurized milk was cooled to 50° and later to 60° by running water or brine into the jacket. In the second experiment the tank-pasteurized milk was cooled by running it over a surface coil cooler and immediately bottled. In the first experiment the samples for bacterial counts were taken immediately after the milk had been cooled, but in the second experiment they were not taken until the next morning. All bacterial counts were made on 1 per cent dehydrated nutrient agar incubated at 37° C. for 48 hours. The cream line was determined in graduates during the first experiment, samples being taken at the same time as the samples for the bacterial count, but the cream raising during the second



experiment was determined in the bottles. Flavors and odors were noted on samples held over night after first heating the milk.

On several of the days in each experiment the bacterial count was lower in tank-pasteurized milk, and on several days the reverse was true. The average efficiency of pasteurization in reducing the bacterial count by the tank method was 95.7 per cent in the first experiment and 92.8 per cent in the second. The average reductions in bacteria by the in-the-bottle method were, respectively, 96.3 and 93.3 per cent. The amount of cream rising was slightly greater on the milk pasteurized in the bottle in the first experiment but less in the second. The explanation of this is that cooling was slower in the tank in the first test, but more rapid when the coil cooler was used in the second test. The flavor and odor were slightly better for the tank-pasteurized milk. The glass enameled tank combined with a surface coil cooler is preferred by the authors to pasteurizing in bottles. The data are tabulated in detail.

Some studies on the neutralization of cream for butter making, H. C. JACKSON (*New York Cornell Sta. Mem.* 71 (1923), pp. 3-18).—The results of an investigation of the value of neutralizing cream for butter making are reported. These include comparative studies of neutralizers, the scores of butter made from neutralized and unneutralized cream, bacteriological studies of cream held from 3 to 14 days at 55 to 60° F. and at 70 to 75°, and the scores of the fresh and stored salted and unsalted butter made from samples of this cream which had and had not been neutralized. The acidity, Reichert-Meissl number, and scores of butter when fresh and after 3 and 7 weeks of storage were reported for other samples of butter made from neutralized and unneutralized cream.

To determine the effect of the acidity of the cream on the butter, a sample of cream was divided into four parts. The scores of the unsalted butter made from the different portions were as follows: Churned raw and unneutralized 86.2, pasteurized and unneutralized 86.7, pasteurized and neutralized 88.8, and pasteurized, neutralized, and ripened 87.6 per cent. The scores of the salted butter made from the respective portions of cream were 86.8, 86.2, 88.3, and 88.4 per cent.

The results of the study indicated that lime was the most satisfactory neutralizer, and that butter made from neutralized, pasteurized cream had a better flavor than butter made from unneutralized, raw or pasteurized cream, but there was little difference in the keeping quality. Ripening neutralized cream did not improve the flavor of the butter. A high acid condition or high bacterial count does not necessarily render cream unfit for neutralization.

## VETERINARY MEDICINE.

Veterinary studies for agricultural students, M. H. REYNOLDS (*New York: Macmillan Co.*, 1922, 8. ed., pp. XXI+301, pl. 1, figs. 94).—This is the eighth edition of the work previously noted (*E. S. R.*, 15, p. 718).

The diseases of farm animals in New Zealand, H. A. REID (*Auckland: Whitcombe & Tombs Ltd.*, 1923, pp. XVIII+567, figs. 34).—A popular account of the livestock diseases in New Zealand and means for their control. The first part (pp. 1-162) deals with microbic diseases, the second part (pp. 165-240) with parasitic diseases, and the third part (pp. 243-513) with general diseases. Parts of the livestock act, regulations relating to the cattle tick, blackleg regulations, etc., are appended.

Yearly reports in regard to the progress made in veterinary medicine, edited by W. ELLENBERGER, O. ZIETZSCHMANN, and K. NEUMANN (*Jahresber. Vet. Med.*, 38 (1918), pp. VII+214; 39-40 (1919-1920), pp. V+350).—The first



of these two yearbooks, in continuation of those previously noted (E. S. R., 45, p. 680), reviews the work of the year 1918 and the second the work of the years 1919 and 1920.

**Reports on the civil veterinary department (including the Insein Veterinary School), Burma, for the years ended March 31, 1922, and March 31, 1923.** T. RENNIE and C. J. N. CAMERON (*Burma Civ. Vet. Dept. Rpts.*, 1922, pp. 4+13, pl. 1; 1923, pp. 16, pl. 1).—These are the usual annual reports (E. S. R., 47, p. 878).

**The enforcement of the Kansas livestock remedy law.** L. A. FITZ and A. E. LANGWORTHY (*Kansas Sta. Insp. Circ.* 17 (1922), pp. 60).—The authors first call attention to the fact that this law requires that the English name of each ingredient of a remedy, the actual percentage of certain very active drugs, and the maximum percentage of any ingredient used as a filler, shall be given in the application and on the label. A table is given of the ingredients used in six important classes of registered livestock remedies, their properties, the number of remedies in each class in which each ingredient is used, and the total number of remedies in the six classes in which each ingredient is used (pp. 10-23). A second table is given of livestock remedies registered in Kansas up to July 1, 1922 (pp. 31-60).

**Four deaths caused by sodium fluorid.** W. D. McNALLY (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 10, pp. 811-813).—The author first discusses the toxic effect of sodium fluorid and points out that the literature contains very little regarding poisoning by it. The literature on the subject is reviewed, and four cases, three being accidental deaths and one a suicide, are reported. In all cases, with one exception, death occurred in from 45 minutes to 4 hours, and the lethal dose was between 5 and 10 gm. It is pointed out that, in suspected cases of poisoning, the soluble sodium salt may be rendered inert by conversion to the insoluble calcium fluorid by copious and repeated gastric lavage with lime water or a weak solution of calcium chlorid.

**Livestock poisoning by cocklebur.** C. D. MARSH, G. C. ROE, and A. B. CLAWSON (*U. S. Dept. Agr., Dept. Circ.* 283 (1923), pp. 4, figs. 2).—An unusually large number of reports of poisoning of livestock, more especially swine, by cocklebur during the last three years led to feeding experiments by the authors. These have shown that poisoning occurs from eating the young plants just after germination, the cocklebur being poisonous during the development of the cotyledons, and before the growth of the leaves. The seeds are distinctly poisonous, but it is not thought that animals often eat enough of them to do any harm. The experiments show that swine, cattle, and sheep may be poisoned, the effects being especially marked in young pigs up to 2 months of age. In general, the dose that causes sickness or death is not far from 1.5 lbs. of the green plant to 100 lbs. of animal, and there seems to be little difference between the dose that causes only sickness and the dose that kills. A report that the feeding of whole milk to pigs that had fed upon cocklebur would prevent the poisoning led to experiments which have shown that bacon grease, lard, and raw linseed oil, as well as milk, prevent any symptoms of poisoning.

**Greasewood as a poisonous plant.** C. D. MARSH, A. B. CLAWSON, and J. F. COUCH (*U. S. Dept. Agr., Dept. Circ.* 279 (1923), pp. 4, figs. 2).—The authors present a brief description of *Sarcobatus vermiculatus*, or greasewood, with brief references to reports of stock poisoning by it, experimental work, its poisoning principle, etc. This plant is a shrub, growing under favorable circumstances upward of 9 ft. in height, though ordinarily not exceeding 4 or 5 ft., which is found from the State of Washington to Montana and from California to Texas. Reports from time to time of losses of sheep, presumed to be from eating the greasewood, led to a number of feeding experiments in 1921 and



1922 at the Salina Experiment Station in Utah. The results show that while under most conditions greasewood is good forage, under exceptional conditions it may be very destructive to sheep. Poisoning was found to be due to sodium and potassium oxalates in the plant, taking place only when a considerable quantity of the plant, at least 1.5 lbs. to the hundredweight of animal, is eaten in a very short time. In most cases the poisoned animals succumb. It is pointed out that the trouble may be avoided by taking reasonable care that animals do not graze on the greasewood when they are very hungry.

[**Stock poisoning plants in Nevada**], S. B. DOTEN (*Amer. Sheep Breeder and Wool Grower*, 42 (1922), Nos. 2, pp. 57-60, figs. 4; 3, pp. 113-115, figs. 3; 5, pp. 219, 220, figs. 3).—The three papers here presented, based on feeding experiments and studies conducted by C. E. Fleming, N. F. Peterson, and associates at the Nevada Experiment Station and previously reported, relate, respectively, to death camas, *Zygadenus paniculatus* and *Z. venenosus* (E. S. R., 45, p. 782), the poison parsnip or water hemlock, *Cicuta occidentalis* (E. S. R., 45, p. 782), and squirrel-tail grass, *Hordeum jubatum*, in hay, fatal to ewes and their lambs (E. S. R., 41, p. 782).

The filterable viruses, C. E. SIMON (*Physiol. Rev.*, 3 (1923), No. 4, pp. 483-508).—This account includes a bibliography of 55 titles.

**Studies on local immunity.**—The antistreptococcic dressing, A. BESREDKA and A. URBAIN (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 25, pp. 506, 507).—It is reported that a filtrate of a culture of streptococcus applied for 24 hours as a local dressing on guinea pigs is capable of immunizing them against a subcutaneous inoculation of the same organism 3 days later. The filtrate is prepared as follows: A serum bouillon is seeded with streptococcus and kept for from 8 to 10 days in the incubator. It is then filtered, and the filtrate is reseeded and incubated for the same length of time and again filtered. The liquid thus obtained, in which the organism no longer grows, is used for the dressing. As controls other animals received like dressings of bouillon serum, and this afforded no protection. The filtrate was found to have no effect when injected intraperitoneally.

**Studies in local cutaneous immunity against streptococcus infection in the rabbit**, E. RIVALIER (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 27, pp. 711, 712).—In attempts to obtain local immunity against streptococcus infection in rabbits by applying a bouillon culture to an epilated and scarified or simply epilated section of the skin, it was found that a reaction took place only in the freshly epilated section. Similar results were obtained following intradermal inoculation.

The conclusion drawn is that the skin is sensitive to the streptococcus only in so far as the hair follicles have been injured. Attempts to determine whether the infection of an area of the skin is capable of producing a general skin immunity gave negative results in the 18 rabbits tested. The general immunization of the rabbit either by subcutaneous or intravenous injection of streptococci killed by heat or alcohol-ether did not confer cutaneous immunity on the 8 rabbits tested. Results similar to those reported above by Besredka and Urbain for guinea pigs were obtained in the immunization of 4 rabbits by the intradermal injection of a streptococcic filtrate. A local cutaneous immunity was secured in all cases. The inoculation of the culture filtrate intravenously not only did not protect the rabbits against cutaneous inoculation but appeared even to favor the extension of the lesion.

**Diseases of cattle causing sterility and abortion**, S. J. SCHILLING and W. L. BLEECKER (*Ark. Agr. Col. Ext. Circ.* 152 (1923), pp. 28, figs. 10).—A summary of information on the subject.



**The abortion problem in farm livestock**, L. VAN ES (*Nebraska Sta. Circ.* 21 (1923), pp. 3-46, fig. 1).—This is a summary of the present status of knowledge of abortion in cattle, swine, horses, and sheep.

**Studies on *Bacillus anthracis* from the feces of guinea pigs fed with anthrax material**, W. L. HOLMAN and C. A. FERNISH (*Amer. Jour. Hyg.*, 3 (1923), No. 6, pp. 640-648).—This is a more detailed report of an investigation of the portal of entry of anthrax infection which has been previously noted from another source (*E. S. R.*, 48, p. 676). Further evidence is given that, if direct contamination from abrasions in the mouth is avoided, guinea pigs fed large amounts of spores of *B. anthracis* rarely become infected, although spores are found in the feces for several days. The animals were not readily infected through superficial wounds of the skin of the abdomen, nor did they infect themselves from their own feces. Proof was obtained that nonspore bearing anthrax material fed to guinea pigs may give spore forms in the feces. In this connection attention is called to the fact that some spore bearing aerobes normally occurring in the feces of guinea pigs develop colonies that are difficult to differentiate from *B. anthracis*, and that it is necessary in all cases to test isolated cultures by subcutaneous injection.

**Cutaneous vaccination and cutaneous immunity against equine anthrax**, BROcq-ROUSSEU and URBAIN (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 19, pp. 20-22).—A single experiment is reported in which a horse was successfully immunized against localized anthrax by successive intracutaneous injections at 7-day periods of increasing doses of anthrax vaccine. The injections, which were made in the left side of the neck, consisted, first, of 0.05 cc. of the first vaccine, followed by 0.25 cc. of the first vaccine and 0.125, 0.25, and 1 cc. of the second vaccine. Five weeks after the first injection, injections of virulent cultures were begun, starting with 0.1 cc. and increasing to 0.25, 1, 2, 2, and 5 cc., the latter representing more than twice a fatal dose. During the entire period the temperature remained normal except after the final injection, when it rose slightly. There were no other signs of reaction with the exception of slight edema at the site of the injection. The serum of the immunized horse did not protect guinea pigs against anthrax.

**Cutaneous vaccination against anthrax in the horse**, BROcq-ROUSSEU and URBAIN (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 25, pp. 487, 488).—A second successful vaccination of a horse against anthrax by the cutaneous injection of vaccine is reported. In this case only two injections were given, the first consisting of 0.25 cc. of first vaccine and the second, six days later, of 0.25 cc. of the second vaccine in the same place, the right side of the neck. Ten days after the injection of the second vaccine the animal was injected on the other side of the neck with 0.5 cc. of a very virulent anthrax culture. This was followed on the next day by slight edema at the site of the injection. This disappeared in three days, and there were no other evidences of disturbance. No agglutinins could be found in the blood serum of the immunized horse, nor did the serum afford any protection against experimental anthrax in guinea pigs.

**Blackleg: Its nature, cause, and prevention**, J. R. MOHLER (*U. S. Dept. Agr., Farmers' Bul.* 1355 (1923), pp. II+13, figs. 3).—This is a summary of information on blackleg.

**Hemorrhagic septicemia: Its nature, symptoms, and prevention**, J. G. ROBERTSON and M. P. McCLELLAN (*Saskatchewan Dept. Agr. Bul.* 65 (1921), pp. 10).—This is a summary of information on the disease.

**A milk-borne epidemic of septic sore throat in Portland, Oreg.**, R. L. BENSON and H. J. SEARS (*Jour. Amer. Med. Assoc.*, 80 (1923), No. 22, pp. 1608-



1612, figs. 4).—The epidemic reported, which included 487 cases of septic sore throat with 22 deaths, was traced to raw milk furnished by a single dairy. Similar strains of hemolytic streptococci, human type, were obtained in pure culture from the throats of the patients, from the throat of one of the milkers in the dairy, and from the inflamed udder of a single cow in the herd.

"It is probable that the milker in question infected the udder of the cow, producing purulent mastitis; that, on one or more occasions, this cow was milked in with the herd, and that the massed infection thus produced resulted in the epidemic. This cow's udder had both human and bovine strains of hemolytic streptococci. One quarter, containing a human strain, had a massive mastitis indistinguishable grossly from garget. Another quarter, having a bovine strain, was only slightly consolidated."

The history of a "swamp fever" virus carrier, A. F. SCHALK and L. M. RODERICK (*North Dakota Sta. Bul.* 168 (1923), pp. 3-14, pl. 1, figs. 6).—A detailed account of a heavy carrier is presented, including temperature charts of the horse from September 10, 1908, to August 26, 1922. The data presented show that "(1) an artificially infected swamp fever case may survive the disease for 14 years without anemia and then without any apparent exciting factor rapidly break down, showing all the phenomena of a typical field case, including profound anemia. (2) During all that time the virulence of the blood was fully maintained, as shown by not less than 18 positive inoculations. (3) The possibility can not be excluded of the anemia in field cases being merely a culmination of an infection persisting for more or less prolonged periods. This indicates the need of an accurate means of diagnosis of the presence of the infection and thereby the elimination of the carriers. (4) The nonoccurrence of anemia in the experimentally infected cases is no evidence of failure of having the specific infection faithfully reproduced." Preventive measures are also considered.

The standardization of tuberculin, P. A. LEWIS and J. D. ARONSON (*Amer. Rev. Tuberculosis*, 7 (1923), No. 6, pp. 404-411).—Attention is called to the intracutaneous method of testing tuberculin suggested by Mantoux (*E. S. R.*, 21, p. 582). In the experience of the authors the reaction to the intracutaneous injection of tuberculin is very definite in guinea pigs, and the method is thought to offer possibilities as a substitute for the method now in use as being more economical of time and animals and probably more accurate.

Immunological studies in tuberculosis, S. A. PETROFF (*Amer. Rev. Tuberculosis*, 7 (1923), No. 6, pp. 412-444, pls. 2, fig. 1).—The investigation reported in this paper is concerned "with the reaction of the animal body to injections with substances extracted from pulverized tubercle bacilli, and a comparison of these reactions with those induced by the injection of dead tubercle bacilli and by infection with living bacilli." The principal points brought out by the study are as follows:

Skin hypersensitiveness can be induced in animals infected with living tubercle bacilli by a fraction of powdered extracts of tubercle bacilli precipitable by acetic acid in the cold, designated as the "nucleoprotein" fraction and also by the "residue" antigen, described by Zinsser (*E. S. R.*, 46, p. 376), from which the nucleoproteins and coagulable proteins have been removed.

When guinea pigs are treated with considerable quantities of the nucleoprotein fraction of the extracts, a mild type of skin hypersensitiveness is often produced. Thus far it has not been determined whether this reaction is a specific nucleoprotein hypersensitiveness, a milder form of typical tuberculin reaction, or is possibly due to the presence of minute amounts of unextracted fragments of tubercle bacilli.



**Skin hypersensitiveness** has been produced by the injection of dead tubercle bacilli, and this reaction is not prevented by heating the bacilli to as high a temperature as 121° C. under 15 lbs. steam pressure. No skin hypersensitiveness could be demonstrated following the injection of the residue material, even in considerable quantities. Complement-fixing and precipitating antibodies were produced in rabbits by the injection of living and dead tubercle bacilli and the nucleoprotein fraction. The residue material proved incapable of forming antibodies, but gave complement fixation and precipitation tests with potent antisera.

**What are we to do for the repression and eradication of tuberculosis in cattle?** B. BANG (*Cornell Vet.*, 13 (1923), No. 4, pp. 273-291).—The author discusses the results that have been obtained in Denmark and other countries following the adoption of his method of eradicating bovine tuberculosis by separating the reactors from the nonreactors to the tuberculin test and by isolating calves of reacting animals immediately after birth and feeding them raw milk from healthy cows or heated milk from reacting animals. In herds in which the isolation method has been followed for some time, tuberculosis has in many cases been completely eradicated, and in others the process is proceeding satisfactorily.

**Lymphangitis in cattle caused by acid-fast organism**, J. TRAUM (*Cornell Vet.*, 13 (1923), No. 3, pp. 240-245, pl. 1).—This is a report from the California Experiment Station of a study of four additional cases of bovine lymphangitis caused by an acid-fast organism (*E. S. R.*, 41, p. 782).

The results reported in the previous paper have been confirmed. In no case was it possible to produce tuberculosis or any pathological condition of diagnostic significance in guinea pigs by the inoculation of the acid-fast organism obtained from the cases studied. The organism was distinguished from tubercle bacilli by its rapid growth on ordinary laboratory media and by the fact that it was not as strongly acid or acid-alcohol-fast as genuine tubercle bacilli.

**Lymphangitis of cattle caused by the Preisz-Nocard bacillus**, J. TRAUM (*Cornell Vet.*, 13 (1923), No. 3, pp. 246-249).—In connection with the above study of lymphangitis in cattle, two cases were observed of lymphangitis caused by the Preisz-Nocard bacillus. The disease, while resembling in gross appearance the lymphangitis described in the previous paper, was differentiated from it by the results obtained by guinea pig and cultural inoculations. All of the guinea pigs inoculated intraperitoneally developed orchitis in about 10 days, and in every inoculated tube containing blood media the Preisz-Nocard organism was identified.

**Treatment of a case of dourine with Bayer 205**, L. BALOZET, G. LAVIER, and H. VELU (*Ann. Parasitol. Humaine et Compar.*, 1 (1923), No. 1, p. 70).—Negative results were obtained from the treatment with atoxyl (a total of 28 gm. in 6 injections in 11 days) of a horse suffering with paresis of the hind quarters, this paresis remaining practically unaltered. Treatment about two weeks later with Bayer 205 resulted in rapid improvement, and after a week paralysis had entirely disappeared. Two months later the horse was used for severe military work, and no abnormality was noted. Treatment with Bayer 205 consisted in the intravenous injection of 1 gm. in a 10 per cent solution on the first day, followed on the second and fourth days by 4 and 2 gm., respectively.

**Strongylus tetracanthus** Mehlis and its pathogenic rôle, A. RAILLIET (*Ann. Parasitol. Humaine et Compar.*, 1 (1923), No. 1, pp. 5-15).—This deals with the history, classification, development, and effect of the attack of *S. tetracanthus*. It is pointed out that this nematode, which in the third and fourth

larval stages lives in the intramucous cysts of the large intestine, is a cause of verminous anemia of equines. A list is given of 24 references to the literature.

**Blood pressure and pulse of the fowl**, B. F. KAUPP (*Vet. Med.*, 18 (1923), No. 10, pp. 919-922, fig. 1).—The author reports investigations, conducted at the North Carolina Experiment Station, which have shown the average blood pressure as taken from the femoral artery in 13 cocks to be 135 mm. The heart-beat of the fowl is shown to be so fast that the pulse can not be counted as in mammals. After the pulse tracing has been recorded on the kymograph, the speed of the kymograph drum between two given points is determined, and the pulse waves recorded are counted. The work has led to the conclusion that the temperature of the fowl is 107.3° F., the respiration of the female fowl 36 per minute, the respiration of the male fowl 20, and the pulse rate of the fowl 350 per minute.

**Observations on one thousand avian autopsies**, C. D. CARPENTER (*Cornell Vet.*, 13 (1923), No. 3, pp. 214-222).—This report is based upon studies conducted at the avian pathology laboratory established at Petaluma in 1920 by the California Experiment Station. In the Petaluma district the losses for the laying stock vary from 10 to 20 per cent per year.

**The preventive treatment of some infectious poultry diseases in the Netherlands**, B. J. C. TE HENNEPE (*Vet. Jour.*, 79 (1923), No. 579, pp. 314-318).—In this paper the author deals particularly with fowl enteritis, under the name of Klein disease.

**The control of the suckered roundworms of poultry**, S. B. FREEBORN (*Cornell Vet.*, 13 (1923), No. 3, pp. 223-231).—In work conducted by the author at the California Experiment Station, it was found that "tobacco dusts containing 1.5 to 2 per cent of nicotin mixed in the proportions of 2 per cent of the dry mash by weight and fed continuously for from 1 to 4 weeks remove practically 100 per cent of the intestinal worms and approximately 80 per cent of the cecum worms. Tobacco infusions are successful in removing the poultry intestinal roundworm, *Ascaridia perspicillum* Rud., but are not recommended as they are toxic, difficult to administer, and have little effect on the cecum worms, *Heterakis vesicularis* Froel. When fed as recommended above, there is little danger of serious loss in egg production. Growing pullets, although eating less mash when it is treated with tobacco dust, make practically the same gain in weight as untreated checks. *Chenopodium*, derrid ('derrisene'), and carbon tetrachlorid were unsatisfactory for the removal of these worms. Nicotin has apparently little effect on the common tapeworm of poultry, *Choanotaenia infundibuliformis* Goeze."

**Avian typhoid**, G. TRUCHE (*Bul. Soc. Cent. Méd. Vét.*, 99 (1923), No. 8, pp. 138-155).—This is a general discussion of the geographic distribution, symptoms, etiology and pathogenesis, and clinical and bacteriological diagnosis of avian typhoid, the morphology and biochemical reactions of the causative micro-organism, and methods of treatment of the disease. The author employs in the control of the disease a heated polyvalent vaccine prepared from virulent cultures of *Bacillus pullorum* and two types of *B. sanguinarum*. These are grown on Martin's agar in the incubator at 37° C. for 24 hours. An emulsion in salt solution is then made of such a strength that 1 cc. contains 5 mg. of the moist culture. This is placed in vials which are sealed and heated for 30 minutes at 56° or 10 minutes at 65°. The dosage employed is 1 cc. for fowls over 2 months of age and for ducks, 2 or 3 cc. for geese and turkeys, and 5 cc. for the larger birds of menageries. Considerable success is reported in the use of auto-vaccines and of specific vaccines killed by alcohol-ether.



## RURAL ENGINEERING.

**Outline of ground water hydrology, with definitions,** O. E. MEINZER (*U. S. Geol. Survey, Water-Supply Paper 494* (1923), pp. IV+71, figs. 35).—This report represents an attempt to outline the different concepts involved in ground-water hydrology and to define the various terms employed. The main subjects dealt with are atmospheric, surface, and subsurface waters and wells, most of the space being devoted to subsurface water.

**The principles underlying the movement of *Bacillus coli* in ground water, with resulting pollution of wells,** C. W. STILES and H. R. CROHURST (*Pub. Health Rpts. [U. S.], 38* (1923), No. 24, pp. 1350-1353).—A brief summary is given of the results of investigations conducted by the U. S. Public Health Service upon the movement of bacteria of fecal origin in ground water. Natural can material from can type privies was used as pollution material, *B. coli* was taken as the bacterial test, and uranin dye was utilized in tracing the movement of water from dosing trenches to more than 400 experimental wells.

The results indicate that pollution with fecal *B. coli* has up to date been definitely and progressively followed in ground water for distances of 3, 6, 10, 15, 25, 35, 45, 50, 55, 60, and 65 ft. from the trench in which the pollution was placed, and uranin has been recovered from these same wells and has spread to other wells at distances of 70, 75, 80, 85, 90, 95, 100, 110, and 115 ft. from the pollution trench. The soil in question is a fine sand with an effective size of 0.13 mm.

Pollution was found to travel these distances within a period of 27 weeks and only in the direction of the flow of the ground water. It traveled only in a thin sheet at the surface of the zone of saturation. Even when heavy pollution was recovered at the top, water from lower levels was negative both for uranin and *B. coli*. As the ground water level fell, owing to dry weather, the pollution tended to remain in the sand above the new lower ground-water level, namely, in the new capillary fringe.

No evidence was obtained which would justify the conclusion that either the bacteria or the uranin is carried or moves to any appreciable distance in the capillary fringe itself, and there is said to be neither theoretical reason nor experimental evidence to justify the conclusion that either the bacteria or the uranin progressed in the dry, aerated intermediate belt between the capillary fringe and the upper soil belt. All present evidence is said to indicate that when the ground water level falls the pollution remains practically stranded in the capillary fringe or in the intermediate belt, according to the degree of fall of the ground water.

A rainfall of 1 in. resulted in a rise of from 5 to 6 in. in the ground water table in the particular experimental area used. If this rise was sufficient to reestablish the zone of saturation at the level of the stranded pollution, the bacteria and uranin were again picked up and carried along farther in the direction of the ground water flow until dry weather again intervened to cause another fall of the ground water level. It is thus concluded that the progressive movement and the stranding of the pollution are intimately connected with, are dependent upon, and alternate with the rise and the fall of the ground water level, and that this latter factor is dependent upon the alternation of wet and dry weather.

In another series of experiments human feces were buried in pits in a locality of high ground water and covered with sawdust. Of five samples taken three years and two months after burial all were both macroscopically and microscopically recognizable as feces. Three of these samples were positive

and two were negative for *B. coli*, and ova of *Ascaris lumbricoides* were recognizable in all five samples, but all found were dead. The practical bearing of these results upon the intermittent pollution of wells, the location of water supplies, and the justification of laws forbidding the use of abandoned wells for the disposal of excreta are considered self-evident.

**Water resources of California**, P. BAILEY ET AL. (*Calif. Dept. Pub. Works, Div. Engin. and Irrig. Bul. 4* (1923), pp. 55, pls. 4, figs. 3).—This is a report to the State Legislature of California, comprising the results of a state-wide investigation of water resources, with particular reference to their use for irrigation. It includes sections on climates, water supplies and their utilization, and land settlement.

**Flow in California streams**, P. BAILEY ET AL. (*Calif. Dept. Pub. Works, Div. Engin. and Irrig. Bul. 5* (1923), pp. 557, pls. 68, figs. 465).—This is Appendix "A" to the above report on the water resources of California. It contains the results of measurements of flow on practically all the streams in the State of California which are of importance from the standpoint of irrigation, and includes numerous tables of data, drawings, and graphic illustrations.

**Irrigation requirements of California lands**, P. BAILEY ET AL. (*Calif. Dept. Pub. Works, Div. Engin. and Irrig. Bul. 6* (1923), pp. 196, pls. 7, fig. 1).—This is Appendix "B" to the report on the water resources of California. It contains sections on the agricultural lands of the State, climatology, duty of water for irrigation, monthly irrigation demand, irrigation requirements of agricultural lands, net area irrigated in large agricultural districts, and endurable deficiencies in an irrigation supply. A summary of agricultural areas and net duty of water in 16 sections of the State shows that the net duty of water varies from 1.25 ft. in the north coast and San Diego areas, each considerably less than 1,000,000 acres in extent, to 3 ft. in the Imperial, Coachella, and Palo Verde Valleys, covering considerably over 1,000,000 acres. The San Joaquin Valley, which is the largest area, covering nearly 5,500,000 acres, has a net duty of water of 2 ft.

**Rio Grande irrigation project**, C. B. HUDSPETH (*U. S. House Represent., 67. Cong., 4. Sess., Com. Irrig. Arid Lands, Hearings on H. R. 13550 pp. II+58*).—The text of these hearings is presented.

**The corrugation method of irrigation**, J. C. MARR (*U. S. Dept. Agr., Farmers' Bul. 1348* (1923), pp. 24, figs. 25).—This bulletin describes approved practices in the use of the corrugation method of irrigation and points out its advantages and limitations. The method is said to be well adapted for the efficient application of water to steep or irregular slopes, where it is necessary to use a small stream of water, or for new land which has not yet been thoroughly prepared for irrigation. It may sometimes be used to advantage in conjunction with the border method of irrigation as a means of spreading the water evenly over the border strip.

**Relation between soil properties and spacing of drains**, [F.] ZUNKER (*Landw. Jahrb., 56* (1921), No. 4, pp. 561–603, figs. 4).—A detailed analysis to determine the fundamental principles of physics governing the lateral and vertical movements of water in soils, with particular reference to the action of pipe drains, is followed by the results of field and laboratory studies on the subject.

These indicated that the estimation of the so-called heaviness, or degree of permeability of soils, by means of touch, is an unsatisfactory basis for estimating the spacing of drains, and that the mere consideration of settleable particles of soil leads to serious errors in this respect. The Fauser formula for drain spacing, while based partially on the amount of fine materials in soils,



was found to introduce important errors. The Rodewald-Mitscherlich hygroscopicity theory also proved untenable as a preliminary basis for determining drain spacing.

It was found that drain spacing is a function of specific surface of mineral soils, and that for a gram of such soil the specific surface is inversely proportional to the effective grain diameter in millimeters. This resulted in the equations

$$E=\psi'(U), U=\frac{1}{d_w}, O=\frac{60}{s}\times U \text{ sq. cm. per gram,}$$

in which  $E$  is the drain spacing,  $U$  is specific surface,  $d_w$  is the effective soil grain size,  $O$  is true surface, and  $s$  is specific weight. Specific surface was found to be an obvious measure for the degree of permeability of a soil.

The graphic expression of soil grain sizes as abscissas in decreasing geometric series and of the corresponding weights in progressive summation as ordinates was found to yield so-called grain proportion curves, which give an accurate graphic expression of the distribution of soil grains by groups.

From the physical analyses and tabular and graphic data, it was found that for the group containing grains from 2 to 0.1 mm. of weight  $g_1$ ,  $U_1 = 3.17 g_1$ , for grain group 0.1 to 0.05 mm. of weight  $g_2$ ,  $U_2 = 14.43 g_2$ , for group 0.05 to 0.01 mm. of weight  $g_3$ ,  $U_3 = 49.7 g_3$ , and for group 0.01 to 0.002 of weight  $g_4$ ,  $U_4 = 248.5 g_4$ . For a group of grains of greater size than 0.1 mm. and using  $x$  as the smallest abscissa of the grain proportion curve

$$U_1=0.72133\left(\frac{20-2x}{4.322-x}\right)g_1.$$

For grain sizes less than 0.002,  $U_5=0.72133\left(\frac{2y-1000}{y-9.966}\right)g_5$ , in which  $y$  is the abscissa of the high end point of the grain proportion curve. The specific surface of a soil covering the range of grain sizes on a proportion curve from  $d_x$  to  $d_y$  with a weight of  $g$  gm. is expressed by the equation

$$U=\frac{0.72133 (2y-2x)}{y-x} g,$$

in which  $x=1-\frac{\log d_x}{\log 2}$  and  $y=1-\frac{\log d_y}{\log 2}$ .

The finest grain sizes were found to have a marked influence upon specific surface. The general relation between drain spacing and specific surface was found to be

$$E=a-b\sqrt[3]{U} \text{ meters,}$$

in which  $a$  and  $b$  depend upon the proportions of different grain sizes present, the plant growth, and the degree of cultivation.

On the basis of the experimental data, it is shown that for the soils of Bohemia

$E=24-1.5\sqrt[3]{U}$  meters; for those of Württemberg,  $E=27-1.68\sqrt[3]{U}$  meters; and for those of central and eastern Germany,  $E=30-2\sqrt[3]{U}$  meters.

The average annual rainfall was found to be relatively unimportant. It is brought into consideration, however, in the modified drain-spacing formula

$$E=a-b\sqrt[3]{U}\sqrt[3]{n} \text{ meters,}$$

in which  $n$  is the ratio of annual run-off after drainage to normal run-off. The variations in volume weight of the soil had little influence on drain spacing and could be disregarded.

It is concluded that for a practical determination of the specific surface of a soil, the soil should first be separated into its different grain sizes by means of the Kopecky sedimentation cylinder and the smallest particles computed on the basis of observed rate of sedimentation by the Stokes formula. The gradation in specific surface can also serve to indicate the individual characteristics of the different kinds of soil.

**Determination of the specific surface of soil**, F. ZUNKER (*Landw. Jahrb.*, 58 (1923), No. 2, pp. 159-203, figs. 10).—In continuation of the work noted above, the author describes methods and apparatus and reports experimental data on the determination of the specific surface of soil. This work is based on the assumption that the specific surface of a soil is a factor indicating how many times greater the surface of a unit volume of the soil is than that of an equal volume weight of a soil with grains 1 mm. in size. Special attention is drawn to the relation between specific surface and drain spacing, and between hygroscopicity and drain spacing. Much of this data is reduced to mathematical expressions.

**Small storage reservoirs**, W. S. H. CLEGHORNE (*Union So. Africa Dept. Agr. Jour.*, 6 (1923), No. 6, pp. 545-552, figs. 6).—Practical information on the planning and construction of small reservoirs for storing water generally pumped by windmills is presented, particular reference being made to conditions in Potchefstroom, South Africa.

**Reinforced concrete pipe for transmission of water under pressure**, W. G. CHACE (*Amer. Concrete Inst. Proc.*, 19 (1923), pp. 67-74, figs. 5).—Technical information on the design of reinforced concrete pipe for the transmission of water under pressure is presented, together with detailed drawings of typical sections.

**Experiments with clay in its relation to piles**, A. S. E. ACKERMANN (*Soc. Engin. (Inc.) Trans.*, 10 (1919), No. 2, pp. 37-80, pls. 2, figs. 18).—This paper records the results of 95 experiments to determine the relationship between the horizontal pressure and the depth at any given point in clay.

The results showed that for tapered bodies gradually forced into clay the load necessary to produce a given penetration is proportional to the area of the surface of contact between the clay and the body, and is much greater the less the percentage of water in the clay.

Clay containing a definite percentage of water and at a definite temperature had a definite pressure of fluidity. When this pressure was reached and maintained, the clay yielded indefinitely as a dense viscous fluid unless restrained. The pressure of fluidity was greater when the percentage of water was less or when the temperature was lower, and it was independent of the depth.

For equal depths tapered piles were found to support a larger load per unit volume of the pile than those having parallel sides. Parallel piles with blunt ends were not so efficient per unit volume.

The mean intensity of friction for the same depth of penetration on the sides of parallel piles was greater in the case of piles of small cross section than in the case of larger ones, but a reduction of the diameter of the pile beyond a certain point caused the mean intensity of the friction to decrease. Pointed piles were more efficient per unit volume of pile than blunt ones. The resistance to penetration was considerably greater the lower the temperature of the clay. The density of clay was found to decrease as the percentage of water increased.

When forcing a disk into clay the sides of the hole did not crush in unless a certain critical depth was reached. When the penetration was carried far



enough the static head of the clay equaled the pressure of fluidity, and the sides of the hole near the bottom crushed in.

The friction of clay on wood was found to be greater than on tin plate, and the tensile strength of the clay tested was greater when it was raw and dry than when it was baked. It was further found that clay is elastic, and that the contraction on drying probably increases as the percentage of the water in the clay increases.

**The physical properties of clay,** A. S. E. ACKERMANN (*Soc. Engin (Inc.) Trans.*, 11 (1920), No. 7, pp. 196-226, pls. 2; 12 (1921), No. 2, pp. 87-114, figs. 7; 1922, pp. 151-199, figs. 11).—The first of these three papers reports the results of 107 experiments and is a continuation of the above.

The results indicated that the effect of temperature on the supporting capacity of clay appears to be limited to stresses below the pressure of fluidity. The sides of the hole appeared to crush in under the action of a disk before the static head equaled the pressure of fluidity.

The tensile strength of clay was found to increase as its water content decreased, and its contraction on drying increased as the original water content increased. For the penetration of tapered bodies in clay containing a given percentage of water, the surface of contact was found to be directly proportional to the load causing penetration. The work done per unit volume in causing displacement alone increased with the angle of the penetrating pyramid, and the work done in causing displacement by means of a disk was greater than that done in the case of a pyramid.

The coefficient of friction or adhesion increased with the pressure of the clay on the surface. The pressure of fluidity appeared to be considerably reduced when the clay became thoroughly air-dried and was then wetted and puddled. The volumetric displacement caused by a steel ball falling on a surface of clay was directly proportional to the height of the fall. A comparison of the physical properties of wet powdered clay and chalk is also given.

The third contribution to the subject deals with the results of 49 experiments.

It was found that boiling clay decreased its pressure of fluidity about 25 per cent. The mean radial speed of flow of the clay from beneath the edge of a disk was about one-eighth the speed of the penetration of the disk. When a disk penetrated clay there appeared to be a stagnant cap of clay immediately under the disk which traveled down with it. Clay containing 25 per cent of water behaved as a solid and not as a fluid even under considerable tangential stress. The addition of an artificial head to the top surface of clay increased its pressure of fluidity, but even when the addition was as much as 200 per cent of the actual head, the increase of the pressure of fluidity was only about 7 per cent when the clay contained 25 per cent of water.

When clay was discharged under pressure through sharp-edged circular orifices, the rate of discharge increased more rapidly than the rate of increase of pressure, and ultimately there was a phenomenon analogous to the pressure of fluidity, which is called the critical pressure of extrusion. When the orifice was plugged for a couple of hours and then unplugged, the discharge was considerably less for some time than immediately before plugging. The discharge per unit area of orifice for a given pressure decreased as the area of orifice decreased, and the initial pressure necessary to cause the discharge to begin increased considerably as the diameter of the orifice decreased. The greater the pressure the greater was the increase of discharge per unit of area of orifice when changing from a small to a larger orifice.

When the pressure of fluidity was reached it was found that the load on a penetrating disk was the same as that on a sphere. The resultant pressure of fluidity was independent of the diameter of the disk or sphere within a considerable range.

The fourth paper of this series records the results of 24 final experiments. Data on pile-set gauges are appended.

**Building in cob and pisé de terre** ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Bldg. Research Bd., Spec. Rpt. 5* (1922), pp. [3]+40, pls. 9, figs. 3).—Following an introductory statement by H. O. Weller, this report is divided into two parts. Part 1, on cob construction, contains articles on Cob Walls, from notes by J. L. Manson; Clay Lump Building in Norfolk, by P. W. Barnett; and Mud Walling in Bengal, by C. G. Monro. Part 2, on pisé, contains articles on Pisé de Terre and "Le Terradamente System" in Belgium, both by P. W. Barnett; and Pisé de Terre in the Simla Hills, by A. R. V. Armstrong.

**Sand-lime and other concrete bricks**, H. O. WELLER ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Bldg. Research Bd., Spec. Rpt. 1* (1921), pp. 11).—This report presents information on the manufacture, durability, and use of sand-lime and cement concrete bricks.

**Highways and highway transportation**, G. R. CHATBURN (*New York: Thomas Y. Crowell Co., 1923*, pp. XX+472, pls. 32, figs. 22).—The primary object of this book is said to be to sketch briefly and simply the development of the transportation systems of the United States, to indicate their importance and mutual relations, to present some practical methods used in the operation of highway transport, and to make occasional suggestions for the betterment of the road as a usable machine for the benefit of mankind. It contains chapters on transportation a measure of civilization, transportation development in the United States—early trails and roads, waterways and canals, railroads, the modern wagon road, interrelation between highway and other kinds of transportation, automotive transportation, planning highway system—selection of road types, effect of ease and cost of transportation on production and marketing, financing highways and highway transportation lines, highway accidents and their mitigation, highway esthetics, and aids and attractions to traffic and travel.

**Electricity in German agriculture**, A. PETRI (*Elect. World*, 82 (1923), No 3, pp. 123–127, figs. 14).—Machines which have been developed in Germany to facilitate the rural use of electricity under pressure of the present economic situation are described, and data on installations are presented. Some of these installations include threshing, irrigation, and fodder-preserving outfits.

**Wheat threshing in the Punjab**, D. P. JOHNSON (*Impl. and Mach. Rev.*, 49 (1923), No. 578, pp. 212, 213).—Data from threshing experiments with wooden and all-steel threshers are presented and discussed.

Where oats, wheat, and gram were threshed at different stages of ripeness, it was found that the machines worked very well when the straw was tough. However, their success depended entirely upon the condition of the straw. In the all-steel machine, bearings caused many stoppages through heating where lubrication was not automatic, owing to the high temperature existing in the sun at threshing time. The operations included chopping the straw, in addition to separation of grain and straw and cleaning of grain, but the results are taken to indicate that for Punjab conditions this work should be limited to simple threshing and the separation of the grain. Anything which adds to the complication of the machine, such as straw-cutting, should be avoided, since it increases stoppages and lowers the output.



**A simple beehive incinerator**, F. W. SOUTH and G. H. CORBETT (*Agr. Bul. Fed. Malay States*, 9 (1921), No. 4, pp. 263-270, pl. 1).—Drawings and general information on the construction and operation of a beehive incinerator for the destruction of refuse on farms and in villages are presented.

## RURAL ECONOMICS AND SOCIOLOGY.

**David Lubin: A study in practical idealism**, O. R. AGRESTI (*Boston: Little, Brown & Co.*, 1922, pp. VII+372, pl. 1).—This biography of the founder of the International Institute of Agriculture at Rome tells of his infancy and boyhood in Russian Poland and in New York City, his experiences as a pioneer in California, building up a successful business in Sacramento and interesting himself in the transportation of farm products and equal protection for agriculture with other industries, and finally, of his work at Rome (E. S. R., 19, p. 501). The author was first his interpreter and then his co-worker through 14 years in the cause of establishing the International Institute and in his related activities.

**The recovery of agriculture**, D. FRIDAY (*Amer. Rev. of Reviews*, 68 (1923), No. 2, pp. 181-185).—Evidences of agricultural prosperity in the United States are found in comparing the gross value of farm produce for the five years, 1910-1914, with that for the period 1918 to 1922 inclusive. In terms of plain percentages, the gross value in 1922 was 152 per cent of the 5-year pre-war average. Analysis of the items which go to make up our index numbers for the cost of living shows that they do not consist of the things which farmers buy. It is held that when it is considered that the farmer has no outlay for house rent and has normally little or no expenditure for the construction of new houses at this time; that he buys his automobiles and automobile repairs at the pre-war level; and that he produces 60 per cent of the food that he consumes, it is clear that his purchasing power this year should be fully equal to that of 1913.

**The North American farm and certain aspects of rural life**, D. S. BULLOCK (*Rev. Facult. Agron. y Vet. Buenos Aires*, 4 (1922), No. 1, pp. 14-23).—These pages set forth briefly the influence upon the size of farms exerted by the homestead laws, the percentage of cultivated area, the combination of livestock with general farming, and the conveniences found on farms and in rural homes in the United States, with particular reference to Wisconsin.

**Economic studies of dairy farming in New York.—I, Condensery milk without cash crops**, E. G. MISNER (*New York Cornell Sta. Bul.* 421 (1923), pp. 79, figs 9).—This bulletin is the first of a series intended to report by areas some of the findings with reference to the financial condition and the organization of the dairy business. It pertains to 83 farms in the vicinity of Norwich, Chenango County, N. Y. Details of cost and labor income computations are set forth for the year ended April 30, 1922.

Of the 83 operators, 14 had attended high school for an average of 2.2 years, 1 had attended business school for 1 year, and 1 had attended college for 4 years. The average age of the farmers was 45 years. Of the total, 59 farmers owned all the land they farmed, 2 owned part and cash rented additional, and 9 cash rented and 13 share rented all of the land they farmed. The average value placed by the farm operators on their time for 12 months was \$901. The average time spent by the 83 operators was 11.6 months at an average total value of \$876. The average size of the farms was 180 acres with 63 acres in crops, the remainder being largely rough pasture land.

The capital investment per farm was \$12,943, of which 71 per cent was in the farm itself, 21 per cent in livestock, and the remainder in machinery and supplies. The farms had an average value of \$51 an acre. Of the total farm value 54 per cent was in land.

The current operating expenses per farm were \$2,456, of which 35.6 per cent was for cattle and horse feed, 26 for labor, 6.6 for taxes, and 31.8 per cent for other items. The net income or the difference between the farm receipts and the farm expenses was \$469. Subtracting the interest on the capital at 5 per cent, the average labor income on the 83 farms was —\$178. About half of the farms made more than interest on the capital, but only three furnished labor incomes exceeding \$1,000. The receipts per farm lacked \$89 of equaling the farm expenses and the cash living expenses of the operators' families.

The costs and returns for the dairy enterprise including 2,073 cows are summarized, indicating the net cow cost of producing milk as \$2.73 per 100 lbs. and the herd cost as \$2.81 per 100 lbs. With concentrates at current prices and labor at 27 cts. per hour, the average loss per cow was \$34.59 in addition to an average decrease in the market value of cows of \$18.31 per head. The loss per 100 lbs. of milk sold was 69 cts. After all charges except labor were met, the returns were 3.2 cts. per hour for all time spent on the enterprise.

In this area, 70 per cent of the cows were raised and 30 per cent were purchased. There was a total of 582 heifers on 81 farms, or an average of 7 to the farm, of which 12 per cent were purebred. The average cost for 2 years of raising heifers was \$77. Data are presented showing the labor distribution through the year and the use of fertilizers and lime in fertility maintenance.

**Poultry farming in New Jersey**, A. G. WALLER and W. C. THOMPSON (*New Jersey Stat. Circ.* 153 (1923), pp. 31, figs. 8).—The data presented in an earlier bulletin (E. S. R., 40, p. 570) have been condensed and rearranged. In some cases returns from the census of 1920 have been introduced.

**Tractor farming in New Jersey** (*New Jersey Stat. Bul.* 386 (1923), pp. 24, figs. 7).—This study is presented in two parts as follows:

I. *Selection and care*, E. R. Gross (pp. 5–15).—These pages present briefly the principal points to be considered in the selection, care, and use of the farm tractor.

II. *Operating costs and place in the farm organization*, A. G. Waller (pp. 16–23).—Information is given on the cost of running tractors, the manner in which they have fitted into farm organization, and their care. The cost data were obtained by a survey covering operations for the two years 1920 and 1921 on 88 and 101 tractors, respectively. With practically all these tractors two 14-in. plows were used. Of the five principal items of cost, depreciation was the largest. It amounted to about 51 cts. per hour in 1920 and about 57 cts. in 1921, or 36.5 and 41 per cent, respectively, of all costs, exclusive of the operator's time. The fuel cost was 38 cts. and 28 cts. per hour of field work in the two years when full power was required. Changes in farm organization due to the use of the tractor were that the size of farm was increased 7.4 crop acres in Monmouth County and 9.5 acres in Burlington. The depth of plowing increased 0.6 in. in Monmouth County and 1.3 in. in Burlington. Horses have been replaced to some extent, most noticeably on the fruit farms in Burlington County. The man labor saved in Monmouth amounted to 4.5 months per tractor and in Burlington to 5.8 months. Some farm equipment was disposed of, amounting to \$26 per tractor in Monmouth County and \$28 in Burlington.

Some observations with reference to the formation of small holdings in central Italy, G. TASSINARI (*Atti R. Accad. Georg.* [Florence], 5. ser., 18



(1921), No. 3-4, pp. 286-300).—The example is cited of an estate in Perugia in central Italy which was willed in the latter part of 1917 to the lessees and share tenants who occupied the land at the time of the death of the proprietor, the legacy benefiting 48 families. It is held that the creation of small holdings in this manner is destined to bring about in a short time an excessive subdivision of the land, that the new proprietors succeed to the direction of their holdings without sufficient technical preparation, and that such a change results in a smaller total product being put on the market.

**Agrarian reform in Czechoslovakia** (*La Réforme Agraire en Tchécoslovaquie*. Prague: *Politika*, 1922, pp. 31).—The expropriation of holdings exceeding 150 hectares (370 acres) of arable land or 250 hectares of land in general is being carried out according to the law of April 16, 1919, regardless of the nationality of the proprietor or the means of his acquisition of his estate. It is expected that this movement will crystallize national sentiment and prevent rural depopulation and emigration.

**Share tenancy in Spain** (*Internatl. Rev. Agr. Econ.* [Rome], n. ser., 1 (1923), No. 1, pp. 19-36).—The information presented in this article is submitted by the agricultural social section of the Institute of Social Reform recently organized in Madrid, Spain. A somewhat detailed summary is given of the terms of share-tenancy agreements peculiar to certain localities in Spain and to particular industries such as wine and olive growing, cereal production, and stock raising. A bibliography of 11 titles is included.

**Drawing up the farm lease**, C. L. HOLMES (*Iowa Sta. Circ.* 87 (1923), pp. 32).—This circular discusses briefly the more important considerations to be kept in mind in making farm rental contracts and prints in full and gives an explanation of each of the three lease forms known as the Stock-share Partnership Agreement, the Cash Farm Lease, and the Grain-share Farm Lease, which have been furnished to farmers by the Iowa Extension Service for a number of years. A fourth lease form is added here entitled the Stock-share Farm Lease, in which the effort has been made to provide for the usual stock-share rental plan without imposing on the parties the unlimited liability which goes with a partnership.

**Report of the permanent committee of agriculture, immigration, and colonization upon the opportunity of creating a system of agricultural credit**, E. MOREAU (*Rapport du Comité Permanent de l'Agriculture, de l'Immigration, et de la Colonisation sur l'Opportunité de Créer un Crédit Agricole*. Quebec: *Assemblée Législative*, 1922, pp. 237).—The evidence submitted to this committee for Quebec in November and December, 1922, is printed here. A number of statements and extracts of special reports for Canada are submitted in appendixes.

**The mortgage system, with special reference to credit for agriculture**, G. G. BOLLA (*Atti R. Accad. Georg.* [Florence], 5. ser., 18 (1921), No. 3-4, pp. 147-270).—An historical survey is given of the development of mortgage credit under Roman influence in France, Italy, Belgium, and Spain, and under Germanic influence in central Europe. Reforms of recent years, especially in Italy, are reviewed in detail, and the economic and legal aspects of special guaranties necessary in agricultural transactions are discussed. The particular characteristics of agricultural loans and instruments and institutions connected with their effective administration are considered.

**Roadside marketing in Connecticut**, P. MEHL (*Conn. Agr. Col. Ext. Bul.* 65 (1923), pp. 12, figs. 8).—Suggestions are made with respect to types and location of stands, signs and other advertising, grading and packing of products, and salesmanship. In the appendix are given the Connecticut laws regarding advertising on private property and highways.

**Accounting records and business methods for livestock shipping associations**, F. ROBOTKA (*U. S. Dept. Agr. Bul. 1150 (1923)*, pp. 52, pls. 2, figs. 14).—A system of records and accounts based on the methods used by shipping associations in different parts of the country is outlined in this bulletin. The system is specifically designed to meet the needs of livestock shipping associations or those which, in addition to handling livestock, occasionally buy feed and other farm supplies which are unloaded directly from the car and paid for on delivery. The purpose of the blank forms needed and the method of using each is explained. The discussion is supplemented by an analysis of business practices, including terminal market methods and grading and prorating.

**Weather, Crops, and Markets** (*U. S. Dept. Agr., Weather, Crops, and Markets, 4 (1923)*, Nos. 14, pp. 345-376, figs. 3; 15, pp. 377-408, figs. 5; 16, pp. 409-432, figs. 2; 17, pp. 433-456, figs. 2).—Tabulations and charts recording the temperature and precipitation in the United States during the weeks ended October 2, 9, 16, and 23, 1923, are given in these numbers, together with general and local summaries of weather conditions. The usual reports on the receipts and prices and the position in the market of important classes of crops and livestock and of specific commodities are given in each number. A forecast of the cotton crop is published in No. 14. Crop reports included in No. 15 consist of a summary of acreage, condition, production, yield, and farm price of important crops and estimated crop conditions October 1, with comparisons. Index numbers of farm prices of crops and meat animals are given by months for a period of years, also trends of monthly crop forecasts, 1912-1923, and the usual farm price tables. A note with reference to Canadian wheat milled under bond in the United States appears in No. 14.

**Farmers' Market Bulletin** (*North Carolina Sta., Farmers' Market Bul., 10 (1923)*, No. 64, pp. 8).—Brief notes presenting the market news service available to farmers in North Carolina are given here, in addition to the usual partial list of products which farmers have for sale.

**Proposed modifications and recent tendencies in rural government and legislation**, E. H. RYDER (*Mich. Acad. Sci., Arts, and Letters, Papers, 1 (1921)*, pp. 208-212).—A number of efforts toward the improvement of rural government are noted, California and Maryland having amended their constitutions to enable counties to organize for home rule.

**Agricultural cooperation: A selected and annotated reading list**, compiled by C. GARDNER (*U. S. Dept. Agr., Misc. Circ. 11 (1923)*, pp. 55).—A list has been compiled which includes books and periodicals in English having special reference to purchasing, marketing, and credit. Brief bibliographical notes are given for the authors.

[**Cooperative democracy among agricultural producers**], J. P. WARBASSE (*In Cooperative Democracy. New York: Macmillan Co., 1923*, pp. 317-346).—This chapter from a discussion of the theory, philosophy, methods, and accomplishments of the cooperative movement sets forth the author's ideal for farm ownership by consumers and cooperative production through joint cultivation of the land.

**Cooperation in Argentina**, D. BÓREA (*Internatl. Rev. Agr. Econ. [Rome], n. ser., 1 (1923)*, No. 1, pp. 81-117).—This study presents statistics for 1920-21 and comparative statistics for 1898-99 to 1920-21, showing the returns of agricultural cooperative societies and mutual insurance societies as well as urban cooperative societies. A table is given also which shows the position of all of these societies on December 31, 1921.



The principal types of agricultural cooperative society in Italy, G. COSTANZO (*Internatl. Rev. Agr. Econ.* [Rome], n. ser., 1 (1923), No. 1, pp. 50-80).—These types are grouped in five classes, as credit societies, societies for the purchase of requisites, societies for production and for the sale of produce, labor societies, and landholding societies. The characteristic of each group and the development which societies of each type have attained are outlined, giving statistics.

Crop report for Michigan: Annual summary, 1922, and agricultural statistics, 1866-1922, V. H. CHURCH (*Lansing: Mich. Dept. Agr.*, 1923, pp. 63).—This cooperative report gives statistics of crops and livestock for the current year, with summaries, as noted for the preceding year (E. S. R., 47, p. 493).

[Land tenancy and agricultural production in the Union of South Africa], C. W. COUSINS (*Union So. Africa, Off. Yearbook*, No. 5 (1923), pp. 445-552, pl. 1).—These pages present statistics mainly for the period 1910 to 1921, with interpretative notes along the lines previously noted (E. S. R., 46, p. 895).

An economic guide for Algeria, F. FALCK (*Guide Économique de l'Algérie. Paris: Albin Michel*, 1922, pp. VI+191).—This descriptive and statistical guide contains, with others, chapters on the geography of the region and its agricultural resources.

## AGRICULTURAL EDUCATION.

Agricultural research and education in America, R. G. STAPLEDON (*Jour. Univ. Col. Wales, Agr. Dept.*, 12 (1923), pp. 27-37).—This is an interpretation of the American point of view in the organization and technique of investigation, particularly in plant breeding and agronomy, and a description of some of the problems being investigated.

Report of the special legislative commission on agricultural education, A. C. HARDISON ET AL. (*Sacramento, Calif.: State*, 1923, pp. 76, figs. 10).—This report has been discussed editorially (E. S. R., 49, p. 301).

King's agricultural digest, 1923, edited by G. F. KING (*Clayton, N. J.: G. F. King*, 1923, pp. 187, figs. 155).—Brief biographies are given of white and colored agricultural teachers and of Federal and other administrators of agricultural affairs who have influenced negro agriculture and rural living conditions.

Consolidation and transportation problems, J. F. ABEL (*U. S. Bur. Ed. Bul.* 39 (1923), pp. 22).—The report of the second national conference on consolidation of rural schools and transportation of pupils held in Cleveland, Ohio, February 26, 1923, is presented here. The discussion was limited to the three phases of the subject, the training of administrators and teachers for consolidated schools, the determination of what constitutes an adequate unit of support and a reasonable unit of territory for the consolidated school, and the arrival at a uniform terminology or a general understanding of the terms used in a study of centralization in the various States.

Rural education, A. W. ASHEY and P. G. BYLES (*Oxford: Clarendon Press; New York: Oxford Univ. Press, Humphrey Milford*, 1923, pp. 227).—The report is made of a detailed survey of rural education in Oxfordshire, England, in 1920.

Agricultural education in Norway, O. T. BLANES (*Internatl. Rev. Sci. and Pract. Agr.* [Rome], n. ser., 1 (1923), No. 1, pp. 1-12).—The general position of agriculture in Norway is described as well as the schools for agriculture, horticulture, dairying, forestry, and household management. These fall in the two classes of higher teacher training schools and practical schools.

**Report of the State schools for teachers of home economics for the school year 1921-22**, F. B. TORP ([Norway] *Landbr. Direkt. Årsberet., Tillegg M, Beret. Statens Lærerinnøskole Husstell*, 1921-22, pp. 20).—This annual report succeeds the one previously noted (E. S. R., 48, p. 496).

**State training schools for teachers of small holders, 1921**, M. F. NILSSEN ([Norway] *Landbr. Direkt. Årsberet., Tillegg K, Statens Småbruks-lærerskole Beret.*, 1921, pp. 83, figs. 17).—This supplement to the annual report of the director of agriculture for Norway presents later information along the lines previously noted (E. S. R., 48, p. 496).

**Present tendencies in the development of vocational agriculture**, C. H. LANE (*Vocat. Ed. Mag.*, 2 (1923), No. 1, pp. 9-14, fig. 1).—This is a discussion of objectives for State programs of part time education for pupils who have entered upon the work of the farm. It is said that as now organized most of the work is of the evening school or class type. A marked tendency is noted in the way of adapting courses to local conditions instead of requiring rather formal and basically uniform state-wide courses. Attempts to improve teacher training methods and criteria recently drawn up at a conference of teacher trainers are briefly cited.

**Cooperation of vocational classes in home economics with other agencies in a health program**, M. E. BRYDON (*Vocat. Ed. Mag.*, 2 (1923), No. 1, pp. 33-37, figs. 2).—A plan for health supervision is presented here which shows the agencies that exert their influences upon the lives of girls and women and the particular stages in which each exerts that influence most importantly. It is emphasized that the home economics teacher reaches the adolescent girl of high school age. The State program of health supervision recently provided by law for the State of Virginia is briefly discussed.

**Nature in farming**, J. W. PATERSON (*Perth: Fred Wm. Simpson, Govt. Prtr.*, 1923, 2. ed., pp. XIV+226, figs. 137).—This is a second edition of a textbook for Australia previously noted (E. S. R., 36, p. 897).

**The new agriculture for high schools**, K. C. DAVIS (*Philadelphia and London: J. B. Lippincott Co.*, 1923, pp. V+494, figs. 325).—The arrangement of topics and the subject matter in each chapter of this textbook on agriculture is made to conform to the project plan of teaching. There are given plans for local unit surveys, problems based upon these, wall charts and placards, debates, field trips, illustrative materials, exercises for the laboratory, projects, and trials with projects. The subject matter includes the production of corn, small grains, sorghums and millets, hay, pasture grasses, root crops, cotton, tobacco, horticultural products, livestock, and related topics.

**Dairy farming projects**, C. E. LADD (*New York: Macmillan Co.*, 1923, pp. XIX+327, figs. [80]).—This is a handbook for dairymen, although it is primarily intended for pupils in Smith-Hughes vocational agriculture courses. A calendar or program of the year's activities on the dairy farm in regions north of the latitude of Washington, D. C., is presented in chapter 1. The chapters following present the subject matter seasonally, as it seems best suited to the regular school year beginning in September.

**Illinois home economics handbook** (*Urbana, Ill.: Home Econ. Ext. Serv., Univ. Ill.*, 1923, pp. [294], figs. 52).—The home economics extension service of the University of Illinois has prepared a loose-leaf handbook as a reference work containing brief and readily available information and data for the home advisers of Illinois. It is arranged in sections on general information, foods, clothing, home furnishings, home management, health and recreation, office work and publicity, and directories and sources.

**Mississippi's methods of providing practice teaching in home economics**, F. FOOTE (*Vocat. Ed. Mag.*, 2 (1923), No. 1, pp. 42-44, figs. 2).—Classes



in home economics and general science at the Columbus High School; food, clothing, and nutrition classes in the practice school connected with the Mississippi State College for Women; and two evening classes in the mill district of Columbus provide teaching experience for the senior class in home economics of the college.

**The practice house v. the student's own home as a means of securing vocational experience,** G. PEABODY (*Vocat. Ed. Mag.*, 2 (1923), No. 1, pp. 39-41).—The report published here consists of a study of the personal opinions of 37 home economics women, 21 favoring the experience gained in the practice house and 16 that gained in the student's own home.

**Status and results of home demonstration work, Northern and Western States, 1921,** F. E. WARD (*U. S. Dept. Agr., Dept. Circ.* 285 (1923), pp. 26, figs. 7).—The results of projects in foods and nutrition, clothing, home management, health, food production and preservation, house planning and furnishing, community enterprises, the work of specialists, boys' and girls' club leaders, and other phases of home demonstration work are set forth in these pages.

**The gifts of nations.—A pageant for rural schools,** M. C. NEWBURY (*U. S. Bur. Ed., Rural School Leaflet* 20 (1923), pp. 12).—A pageant is outlined which may be adapted to classes studying European history and geography and may be given by a group of rural pupils, by several schools combined, or by adults.

### MISCELLANEOUS.

**Abstracts of papers not included in bulletins, finances, meteorology, index** (*Maine Sta. Bul.* 309 (1922), pp. 93-104+X).—This contains the organization list of the station; abstracts of one paper previously noted and of two others abstracted elsewhere in this issue; meteorological observations noted on page 13; a financial statement for the fiscal year ended June 30, 1922; an index to Bulletins 305-309, inclusive, which collectively constitute the thirty-eighth annual report of the station; and announcements as to the work and publications of the station.

**Author index of the publications of the Pennsylvania Agricultural Experiment Station,** W. FREAR and T. I. MAIRS (*Pennsylvania Sta. Bul.* 180 (1923), pp. 56).—This bulletin includes a classified index of the annual reports of the station from 1887 to 1916-17 and of the bulletins from 1887 to May, 1923.

## NOTES.

---

**California University.**—Dr. Elmer D. Merrill, director of the Philippine Bureau of Science, has been appointed dean of the College of Agriculture and has entered upon his duties. Dr. W. H. Boynton, head of the Pandacan Research Laboratories in the Philippine Bureau of Science, has been appointed professor of veterinary science in the College of Agriculture, beginning July 1.

**Florida University and Station.**—H. B. Lansden, specialist in poultry husbandry in the University of Arkansas, has been appointed extension poultry specialist in the university, beginning December 1, 1923. On the same date Dr. Arthur S. Rhoads, plant pathologist in the Missouri Fruit Station, became assistant plant pathologist of the station, having as his particular work the investigation of the citrus disease known as blight or wilt which occurs in various localities along the east coast of Florida.

**Kentucky University and Station.**—The resignations are noted of L. P. Benjamin, assistant bacteriologist; P. E. Bacon, inspector in charge of creamery licenses; F. J. Keilholz, assistant editor; and C. U. Jett, field agent in farm management. Fred Fitschen has been appointed inspector in the department of feed control, and Muriel Hopkins instructor in home economics.

**Maine Station.**—Reiner Bonde, formerly engaged in seed certification work in Nebraska, has been appointed assistant plant pathologist, beginning January 1.

**Massachusetts College and Station.**—On December 1, 1923, J. A. Foord retired as head of the division of agriculture, retaining his previous duties as head of the department of farm management. This change will afford greater opportunity for specialization in the latter subject. Since 1907, when Professor Foord came to the college, the teaching equipment in agriculture has been extended from the full-time services of two men, part-time of a third, and a farm superintendent to a division with six departments, a teaching staff of 17 in the 4-year course, and 8 to 9 in the 2-year course, 3 members engaged in research, and 4 in extension work. Equally striking has been the increase in equipment including the building of a new barn in 1908, the Grinnell Arena in 1911, the Flint Laboratory in 1912 for dairy husbandry, and the imposing Stockbridge Hall now housing the departments of farm management, animal husbandry, agronomy, poultry husbandry, and rural engineering. Several minor buildings and considerable additional land have also been secured.

**American Society of Agricultural Engineers.**—This society held its seventeenth annual meeting at Chicago on November 8, 9, and 10, 1923.

The meeting was opened in general session by an address of welcome by B. H. Heide, chairman of the Chicago Chamber of Commerce. The president's address was given by E. W. Lehmann, who emphasized, among other things, the importance of research in agricultural engineering, and drew attention to some of the more notable achievements in that line during the year. This was followed by an address on Elimination of Waste Through Simplification and Standardization, by R. M. Hudson, who discussed the economic aspects of standardization, with special reference to the farm implement industry. W. H. Stackhouse discussed the manufacture of farm equipment, and C. F. Kettering closed the general session with an address on Engineering Research, with particular reference to its application to agricultural engineering.



The remainder of the main program was divided into five subprograms, corresponding to the farm structures, farm power and machinery, rural electrification, reclamation, and college sections of the society.

The farm structures program was opened by H. B. Walker with a report on sewage disposal projects and research features thereof. Special attention was drawn to the comprehensive studies of farm sewage disposal in operation at the Kansas College. Among these, a study of flow characteristics of household sewage from isolated homes showed that the frequent assumptions of flow ranging from 30 to 75 gal. per person per day are too high.

M. A. R. Kelley reported the results of recent tests of ventilation systems in farm buildings made by the U. S. Department of Agriculture. These tests indicated that a broader fundamental knowledge of the ventilation requirements of animals is needed to serve as a basis for ventilation studies, and emphasized the importance of conducting such studies under more controlled conditions.

J. B. Kelley presented the results of an analytical study of the research features involved in the development of tobacco-curing barns, as a basis for planning a project on that subject. The temperature, ventilation, and moisture requirements of the tobacco under optimum curing conditions were found to be the important factors for consideration as bases for the development of tobacco-curing barns. Special attention was drawn to the cooperative features of such a project, which will involve work by the chemist, plant pathologist, tobacco specialist, and bacteriologist, as well as by the engineer.

A report on building and equipment factors in the cost of dairy products was made by D. G. Carter. K. J. T. Ekblaw presented a brief analysis of the effect of farm storage upon marketing, with particular reference to the use of permanent storages built of concrete.

E. A. Stewart gave a paper on the merits of warm air heating when properly installed, which described some of the experiments being conducted at the Minnesota Station and the practical application of the results in farm homes. T. F. Laist presented a paper on Fire Resistive Construction and Its Application to Lumber-built Farm Structures.

A report on Developments in Farm Building Design by W. A. Foster included the progress results of studies begun and conducted for several years at the Iowa Station on self-supporting barn roofs. E. A. Stewart reported the results of general studies of farm home equipment, with particular reference to heating, lighting, and other conveniences and comforts.

The farm power and machinery program was opened by E. V. Collins with an illustrated paper, describing a dynamometer developed at the Iowa Station for measuring the pulling power of horses and presenting the results of several horse pulling tests, to bring out some of the factors involved in maximum pulling power. The tests brought out, among other things, the influence of the position of the hind feet of a horse on its pulling power, and indicated the relative pulling powers of different breeds and sizes of horse.

L. J. Fletcher presented the report of the committee on the manufacture of farm products. This report dealt primarily with the manufacture of foodstuffs and included, as a main feature, the results of studies of dehydration of fruits and vegetables and of the development and construction of farm dehydrators conducted at the California Station by A. W. Christie and G. B. Ridley. These results demonstrated the application of exact engineering principles to the establishment of any desired condition in a dehydrator, but brought out the importance of securing more fundamental information regarding the best conditions to maintain for the dehydration of various fruits, the factors governing which are numerous, extremely variable, and difficult of exact measurement and control.

In a paper on The General Purpose Farm Tractor, F. A. Wirt discussed both the agricultural and engineering factors entering into small tractor development. E. A. Johnston, O. B. Zimmerman, and T. Brown presented an illustrated paper and discussion on intra-company standardization and its relation to general standardization, with special reference to the farm implement industry. This comprised a comprehensive outline for standardization of all phases of farm implement production, and drew attention to actual instances, such as the reduction in the number of necessary steel types from 73 to 38 and of steel wrenches from 24 to 4.

G. W. McCuen described some power studies by the use of the new belt dynamometer recently developed at the Ohio State University. These indicated, among other things, that a threshing feeder out of adjustment will increase the power requirement quite noticeably. Poor pitching was found to result in an increase of 19.3 per cent of power used over steady pitching. Tests of silo fillers showed that dull knives required 14.78 per cent more power than sharp knives. C. O. Streeter reported the results of a number of belt tests made by a private manufacturer of farm equipment. F. W. Duffee reported the results of 41 tests at the Wisconsin Station of the power requirements and capacities of 15 different silo fillers. These showed that the capacities and power requirements varied within quite wide limits for the same length and uniformity of cut and height of silo. The results were taken to indicate the necessity for a fundamental study of the requirements to be met by a silo filler, to be used as a basis for its development and the standardization of its manufacture.

J. C. Wooley reported the results of a survey by the Missouri Station of the application of machinery to soy bean production. These indicated that the combine harvester or the row thresher are best adapted to harvesting soy beans.

The section program was closed by M. L. Nichols who reported an analytical study of the research factors entering into the subject of soil dynamics, particularly as they influence the movement of tillage and traction machinery through and over the soil. This study emphasized the importance of research to evaluate exactly such soil factors as resistance to penetration, shear, and pulverization, adhesive and cohesive properties, bearing strength, hardness, state of tilth, mechanical and mineralogical composition, specific gravity, humus content, absorptive power, frictional characteristics, specific surface, and moisture limits for optimum tillage conditions in order that they be considered singly or in logical combinations in a manner commensurate with their importance in the development of tillage machinery design. A survey of related studies at several of the experiment stations showed that this work can not be effectively coupled as a whole with standard agronomic methods and classifications, due to the fact that the evaluation of many of the factors mentioned has been made by agronomy departments with an entirely different viewpoint from that of the agricultural engineer. This is taken to indicate the ultimate necessity for an entirely new classification of soils and their properties on the basis of engineering requirements.

The rural electrification program was opened with a general statement of the activities of the committee on rural power lines, by C. A. Atherton, and a review of the history of work undertaken by central stations in supplying electric service to rural districts, by G. C. Neff. C. N. Johnson presented data on the present status of electrical machinery for rural purposes, and E. A. Stewart reported a study made by the University of Minnesota on conditions for supplying electric service to rural consumers. The results indicated that the best method of securing the connecting lines is to have them built by the public utility, the cost to the consumers therefor to be determined on the basis



of the actual cost of construction, and distributed among the consumers on the basis of equal benefit. The best method of making the monthly charge for service seems to be the making of a low rate and the establishing of a fixed minimum charge. A suggested form of contract between public utility and rural consumer was also presented and discussed.

W. H. Roberts presented a brief paper on farm electric service from the isolated plant. J. W. Coverdale of the American Farm Bureau Federation described the organization and work of its committee on the relation of electricity to agriculture. This committee consists of representatives from the U. S. Department of Agriculture, the American Farm Bureau Federation, the National Electric Light Association, the American Society of Agricultural Engineers, and the manufacturers of farm electric plants. The importance of a complete investigation into the application of electricity to agriculture by the U. S. Department of Agriculture and the State experiment stations was emphasized.

H. M. Aylesworth discussed the relation of central station service to rural electrification, bringing out the importance of an arrangement whereby the central station will be enabled to supply electrical energy to the farm and the farmer to use it, with profit to both parties. F. C. Fenton closed the rural electrification program with a paper on Electric Power from the Wind, which was based upon investigations in progress at the Iowa Station on the development of power by windmills.

The reclamation program was opened by a paper on Some New Developments in Land Clearing, by L. F. Livingston. Special attention was drawn to new apparatus for use in stump and root pulling.

S. Fortier presented an exhaustive review of the important advances in American irrigation since 1900. W. Ashby took up the problems of the new settler on cut-over reclaimed land on the basis of actual experience on a large reclaimed tract in northern Minnesota. D. Weeks discussed a new phase of the land utilization problem in the United States.

H. B. Roe presented a paper which was based upon a study by the station of the cost of tile drainage in relation to the value of improved lands in Minnesota. It was brought out that drainage of the waste spots, which will generally bring under cultivation all the land within the present limits of the farm, can frequently be done at a cost per acre not greater than two-thirds of the flat value per acre of the undrained farm, and therefore considerably less than one-half the resultant value per acre of the originally tillable land.

A progress report of investigations by the Wisconsin Station on engineering developments in cut-over land reclamation was made by J. Swenehart. W. P. Miller discussed the difference in soil erosion control measures for the Carolinas and Ohio on the basis mainly of differences in soil types, physical characteristics, and erosive tendencies. J. T. Copeland analyzed some of the engineering aspects of erosion, with particular reference to the location, width, slope, and inclination of terraces. L. L. Hidinger described some of the important features of drainage projects, with particular reference to the formation of drainage districts.

E. R. Gross briefly analyzed the research factors entering into a study of soil drainage as a basis for a general plan of research on the subject. On the assumption that the soil is the thing primarily concerned in drainage, it was concluded that the logical starting point for a study of soil drainage is the establishment and evaluation of the factors governing the movement of water in soils of a broad practical range of mechanical, physical, and chemical composition, to be used as a partial basis for computing run-off. The importance

of cooperative relations with the agronomist and soils specialist in this work was also emphasized.

The reclamation program was closed by M. R. Lewis, who presented the results of a similar analytical study of the research factors in irrigation.

The college section program was opened with a paper on Extension Methods in Agricultural Engineering, by I. A. Wood. Reports followed summarizing agricultural engineering extension activities during 1923, by H. H. Sunderlin, and on the standardization of blue print service for extension purposes, by F. W. Ives. B. R. Buckingham delivered an address on Educational Methods, in which the factors entering into the work on educational research at the Ohio State University were discussed.

The general report of the research committee was given by R. W. Trullinger. This embodied a critical survey of agricultural engineering research at State, Federal, and private institutions in this and in foreign countries during 1923. This survey indicated a quite prevalent tendency for inadequate fundamental consideration of logical starting points for such work, and emphasized the importance of focusing attention, at the beginning, on the requirements of the thing most vitally concerned. The necessity for closer cooperation with the branches of agriculture concerned in each case in the planning and conduct of research work in agricultural engineering was also brought out.

H. B. Walker reported the activities of the committee on positions for agricultural engineering students. J. B. Davidson outlined the aims and objectives of the agricultural engineering curriculum. It was noted that teachers are confronted with the problem of preparing both service and professional courses in agricultural engineering. Some schools have elective courses, while others confine their activities to prescribed courses. The opinion was expressed that the elective system turns out the stronger student, although both policies have their advantages.

The college section program was completed with a report by C. W. Smith on Standardization of Farm Motor and Implement Courses.

The meeting was closed by a business session during which officers for the ensuing year were elected as follows: President, S. H. McCrory of the U. S. Department of Agriculture; vice presidents, L. J. Fletcher of the California Station and E. R. Jones of the Wisconsin Station; secretary and treasurer, Raymond Olney; and member of the executive council, F. W. Ives of the Ohio State University.

---

ADDITIONAL COPIES  
OF THIS PUBLICATION MAY BE PROCURED FROM  
THE SUPERINTENDENT OF DOCUMENTS  
GOVERNMENT PRINTING OFFICE  
WASHINGTON, D. C.  
AT  
10 CENTS PER COPY  
SUBSCRIPTION PRICE, 75 CENTS PER VOLUME



# EXPERIMENT STATION RECORD.

VOL. 50.

FEBRUARY, 1924.

No. 2.

In the confusion of tongues which has characterized the period of agricultural readjustment since the close of the war, substantial unanimity of opinion has prevailed regarding the need of increased attention to the economic aspects of agriculture. The ills now confronting the industry are recognized as mainly economic in their origin, and it is being realized more and more that their remedy must be sought for in the same field. This condition imposes an unusual responsibility upon the agricultural economists of the country for the carrying on and interpretation of research as a basis of constructive leadership. Under these circumstances the status of research in rural economics in the experiment stations becomes a matter of special importance.

One of the fundamental difficulties of the situation was well set forth by President Coolidge in a recent speech in which he stated that "production has outrun the power of distribution and consumption. The farm population is not increasing, but the improved methods of tillage and inventions in farm machinery have all contributed to increase the per capita output." He went on to say that "it is in this direction that the agricultural schools and colleges have placed their major emphasis. Their education has been substantially all on the side of improved methods of production."

A somewhat similar viewpoint has also been currently expressed in the editorial columns of a leading livestock journal of the Middle West. According to that journal, "a number of farm business problems, falling suddenly into new settings, demand consideration. No disparagement is intended when we say that most of our agricultural colleges are 'behind the times,' so far as these problems are concerned. They have not had the time nor the funds to make investigations and researches. Contemporary agricultural leadership, therefore, in farm economics is based to a large extent on theory, and on practices which changed conditions have in part rendered obsolete. So far as farm economics is concerned, we have in this country not a few cases of 'the blind leading the blind.' On one hand, we have some elderly men, well informed in regard

to the past; on the other, a number of young men steeped in theories, based on other theories. Both classes—and all others—are shy on facts which have any relevance to existing conditions. Between the two we have a number of outstanding men who are the brains of this undeveloped science.” Increased attention to research in rural economics was, therefore, strongly advocated.

General acknowledgment there will doubtless be that the field of rural economics is still unexplored in many directions, and that the opportunity for investigations therein is exceptionally promising. If it be recalled that most of the handful of pioneer rural economists are still in active service, this is only what would be expected. None the less, substantial progress has already been made. At the present time, disregarding the large amount accomplished and under way by the Federal Department of Agriculture and various independent agencies, the active projects classified as rural economics and sociology which are being conducted by the experiment stations alone number nearly two hundred, or an approximate average of four projects per station. Thirty-seven States are represented in this group, and of the eleven States for which no projects are reported practically all are those with the smallest station revenues.

In the early days of the stations, agricultural experimentation quite naturally proceeded along the lines of the biological sciences. The language of the Hatch Act as regards the duties of the stations makes specific reference to studies of the physiology and pathology of plants and animals, the composition and digestibility of feeds for livestock, the chemical composition and effects of manures, and numerous other problems relating almost wholly to production. General authority is also given for “such other research or experiments bearing directly on the agricultural industry of the United States as may in such cases be deemed advisable,” but in practice, the limited funds have been utilized quite largely for the type of problems mentioned and have proved inadequate for others except as supplemented from other sources. This factor has doubtless retarded the prosecution of economic studies by the stations in no small degree.

General interest in rural economics as a subject of systematic inquiry, moreover, has been of comparatively recent development. As late as 1890, economics itself, we are told, was still looked on askance by those who pursued what they termed the “exact” sciences, and more than a decade followed before the granting of the first advanced degrees in rural economics. In the issue for September, 1905, the *Record* announced editorially the establishment of a section dealing with the subject, stating that it is now “receiving



more attention as a branch of agricultural instruction and investigation, and matters within its scope now go to make up a considerable literature." Not until over a year later, however, was the first station bulletin abstracted in the new section, a report of studies of the cost of producing farm products conducted cooperatively by the Bureau of Statistics of the United States Department of Agriculture and the Minnesota Station, issued jointly by these institutions. During the first year only forty-eight abstracts appeared from all sources, about one per cent of the total for all subjects in the *Record*. If this is compared with the three hundred and ninety-three titles included in the fiscal year 1923 and constituting nearly six per cent of the total number, a rough comparison of the increasing activity may be afforded.

Another measure of the evolution of the subject may be found in the gain in personnel. Ten years ago only nine stations reported workers in rural economics and sociology, and these numbered collectively but eighteen, of whom twelve were in farm management. By 1920-21, the register had increased to thirty-three in farm management and twenty-eight in other branches of rural economics and sociology. The latest figures available, those for 1922-23, show a total of one hundred and thirteen workers, of whom forty-five are assigned to farm management and eleven to marketing investigations.

Still further indication of the increasing realization of the responsibilities of the agricultural colleges along economic lines is afforded by a scrutiny of the recent proceedings of the Association of Land-Grant Colleges. A decade ago little interest was apparent, but of late years the economic viewpoint has been strongly in evidence. Attention has already been called in these columns to the fact that at Chicago last November two of the three joint sessions of the section on agriculture dealt very largely with economic questions, and that there was frank recognition of the need of enlarging, so far as the resources of the institutions permitted, the opportunities for education and research in rural economics and sociology as a means of coping with the untoward economic conditions confronting the agriculture of both the present and future.

The range of the economic studies now under way at the stations is considerable but by no means exhaustive. The largest group of projects is that dealing with cost of production and accounting. The sixty-three projects listed in this group represent approximately one-third of the total number, and they are distributed among twenty-seven of the thirty-seven stations engaged in economic studies. Of the remaining projects, thirty-six deal with farm organization and management and twenty-eight with marketing, with relatively

smaller numbers for rural sociology, land tenure, farmers' cooperative organizations, rural credit, land values, farm labor, and miscellaneous topics.

Many of the projects on cost of production relate only to a single commodity and in most cases deal with localized areas. The handicap of State border lines also enters in on some of the other lines of investigation. This was frankly recognized as a weakness of these studies in the recent presidential address of Director Cooper of the Kentucky Station before the American Farm Economic Association, in which he pointed out that "much of the investigation required is broader than State lines. Therefore, it involves sectional agreement upon policy and indeed often national assistance through the Federal Department. In many fields the Department of Agriculture is the logical leader."

One difficulty in the past has been that many economic inquiries by the stations have consisted too largely of the mere collection of data. The assembling of facts is of course indispensable, especially in view of the tendency to theorize without an adequate foundation which has sometimes characterized even well-meaning proponents of remedies for the economic ills of agriculture. In this direction the colleges and stations have been notably conservative. Not infrequently, in fact, they have published their records and their findings with very little comment or conclusions, leaving the reader quite uncertain as to the application of even extended and comprehensive inquiries and therefore disposed to criticize the work as without practical value. Sometimes, to be sure, no other course has been possible, but in other instances the interpretation of the data and the formulation of such generalizations and applications as may be warranted is no less a duty than its collection and publication. The elucidation of principles and laws in their bearings on agriculture is of course the aim and fundamental object of the whole inquiry.

Many of the smaller studies are in need of correlation if they are to be of more than local value. This calls for cooperation of a regional or national character, and the mechanism for securing this has not yet been fully developed. Certain aspects of this problem might prove a profitable field of work for the experiment funds and work committee of the American Farm Economic Association, which, it is somewhat surprising to note, had no report to make on any topic at the last annual meeting. It is also possible that some of the data already collected by the various stations might be worked over and elaborated by the numerous economic foundations and similar bodies which have sprung into existence within recent years.

As in the early days of biological investigation, many of the lines of work undertaken have been of relatively simple type, leaving the more complex inquiries till the coming of greater resources and im-



proved methods of experimentation. It is well realized that some of these postponed projects are fundamental in nature, and there will doubtless be attempts at their solution whenever conditions will warrant.

Reference was made in the presidential address already mentioned to the need of broadening the scope of station work in economics by an extension of effort in what Director Cooper termed the field of "business economics." In his opinion, the popular conception of the application of economics to agriculture is now restricted largely to those functions that relate primarily to the disposition of farm products or their financing. As he puts it, "there is basis for the thought that progress in determining economic fact has been slow, for it must be admitted that certain phases of agricultural interests have been but barely touched upon by the colleges and Federal Government. The institutions provided for agricultural investigation have progressed but slowly in that phase of agricultural economics that treats particularly of distribution, financing, and the farmer's broader relationship to other industry and legislative problems. Neither have institutions made more than appreciable progress in teaching farmers in this field of economic fact. Too often and too long have our institutions either maintained silence upon these problems or reflected to a degree popular opinion or popular demand." In consequence, "too frequently the farmer has been forced to rely upon organizations and the individual opinion and observation of the demagogue."

The branch of business economics to which the stations have made the most noteworthy contributions is doubtless that of farm management. Historically, it was one of the earliest fields of economic inquiry, and much time was consumed in determining methods and in convincing administrative officers and governing boards of its importance and its application on a broad scale and that farmers would utilize its results. Within a period of about twenty-five years, however, a considerable body of knowledge in this aspect of farming has been developed. "One has but to refer," says Director Cooper, "to the progress made in studies of cost of production, the constantly increasing inquiry upon the part of farmers as to the organization of their farms, the better understanding and application of diversity to the farm business, and many other features of farm management that are freely applied. Farmers are using this information, and it is found in the extension program of teaching in almost every State. This represents a real accomplishment in the field of business that institutions may well be proud of."

To what has been done, however, he would add intensive investigation of the additional fields of business economics. In his judgment "it is not too much to expect that in the next few years our

institutions shall have organized the field of research in the principal phases of business economics as it applies to agriculture. This represents the great present opportunity of agricultural colleges and experiment stations, provided we combine with investigation the active teaching to the farmer of facts as we ascertain them. We must become prepared to teach to the farmer in his rural community the facts that bear upon the broader and national aspects of the agricultural problem. They must be explained in very simple terms and so demonstrated that there shall be no question of political partisanship or membership of a particular economic school of thought. The interpretation should be that of the essential need of agriculture, rather than the claims of the industry or of vocational groups."

Such a program would evidently involve considerable extension of the fields of inquiry hitherto most frequented by investigators in rural economics, and quite probably would encounter difficulties of various kinds. Not the least of these would be the financial aspect already dwelt upon. Few of the stations at present are in a position for additional expansion of any sort, and in general their projects already in progress have been carefully selected and can hardly be supplanted by even meritorious openings in other directions without careful consideration. Gradually, however, readjustments have been brought about in numerous institutions whereby relatively unpromising or minor projects in other fields have been terminated and opportunity thereby afforded for timely and much appreciated studies along economic lines. Specific instances can be cited of stations receiving no increase in revenues since the war where strong departments of rural economics have been built up in much this fashion. It may well be that a careful sifting over of the work under way would reveal others where the full possibilities of the present status have not been exhausted.

There is every reason to believe that the agricultural colleges and experiment stations are keenly interested in the development of rural economics investigations. Despite their limited resources, the necessity of training competent investigators, and other difficulties incident to initiating a new and distinctive kind of investigation, a large amount of work has been accomplished. Studies of much promise are now in progress at most of our institutions, and the work is steadily increasing in scope and value. The provision of additional funds would unquestionably be followed by a still greater and more comprehensive development of this attractive and important field of inquiry.

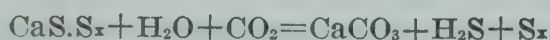


## RECENT WORK IN AGRICULTURAL SCIENCE.

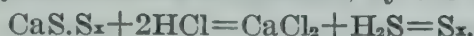
### AGRICULTURAL CHEMISTRY—AGROTECHNY.

**Determination of sulphur compounds in dry lime sulphur, C. P. JONES** (*Jour. Agr. Research* [U. S.], 25 (1923), No. 7, pp. 323-336, figs. 2).—Current methods for determining sulphur compounds in lime-sulphur products are summarized and discussed in their relation to the chemistry of lime sulphur, and two methods which take into consideration the defects of present methods are described in detail. In the opinion of the author, the present methods are open to criticism, particularly because the analyses are based on diluted solutions of the sample in which chemical changes undoubtedly have taken place.

The methods presented are concerned entirely with the determination of the three principal constituents of lime sulphur from the standpoint of insecticidal and fungicidal value, i. e., monosulphid, residual, and thiosulphate sulphur. Both methods are based upon the fact that the acids used are more highly ionized than hydrogen sulphid and have the power of decomposing the polysulphids of calcium with the liberation of hydrogen sulphid and deposition of sulphur. Method A, designated as the carbonic acid method, is represented by the equation



and method B, or the hydrochloric-acid method, by the equation



The apparatus for the two methods is the same. An Erlenmeyer flask in which 0.5 gm. of dry lime sulphur is placed is provided with a separatory funnel and two outlets, one connected with a train of bottles containing appropriate solutions for purifying carbon dioxid in method A and nitrogen in method B, and the other with two flasks containing hydrated sodium peroxid in distilled water for receiving the hydrogen sulphid as liberated.

In method A carbon dioxid is forced through the apparatus until all the air has been expelled. From 50 to 60 cc. of distilled water is then added to the reaction flask through the separatory funnel while the carbon dioxid is still being passed through. The flask is shaken continuously for from 3 to 5 minutes and then intermittently until the hydrogen sulphid has been entirely expelled. The contents of the flask is then filtered through a Gooch crucible provided with a thin asbestos pad, and the filtrate is made up to a volume of 200 cc. and titrated with N/20 iodine, with starch as indicator, to determine the thiosulphate sulphur. The contents of the crucible, after dissolving out any precipitated calcium carbonate with hydrochloric acid and washing, is weighed to determine the sulphur in the polysulphid form and free sulphur. The solution containing the sulphur evolved as hydrogen sulphid and collected in the flask containing sodium peroxid is heated on a steam bath to insure complete oxidation, made slightly acid with hydrochloric acid, with methyl orange as indicator, boiled to destroy the hydrogen peroxid and drive off all carbon dioxid, cooled, and made to volume. To 50-cc. portions of the solution 0.5 cc. of 1:1 HCl is added and the sulphate determination made in the usual manner.

In method B oxygen-free nitrogen instead of carbon dioxide is passed through the apparatus until the air has been expelled and sufficient  $N/2$  hydrochloric acid to neutralize the basic constituents contained in 0.5 gm. of dry lime sulphur is added to the reaction flask through the separatory funnel. The amount required is determined by a preliminary titration with approximately  $N/2$  HCl of 0.5 gm. of the dry lime sulphur to which from 50 to 60 cc. of recently boiled distilled water has been added. The passage of nitrogen through the apparatus is continued until all traces of hydrogen sulphid have been expelled from the reaction flask, after which the determination is continued as in method A.

The advantages of the method are discussed in detail, and data are presented showing the accuracy of the various determinations. The advantages claimed are accuracy, simplicity of reaction, and the employment of but few operations. The use of hydrated sodium peroxid for the absorption of hydrogen sulphid is recommended, particularly on account of the fact that the alkalinity of the solution acts as a binding agent, while the 20 per cent of available oxygen serves as a powerful oxidizer.

**The separation of the hexone bases from certain protein hydrolysates by electrolysis,** G. L. FOSTER and C. L. A. SCHMIDT (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 545-553, fig. 1).—The investigation previously noted (E. S. R., 48, p. 9) has been extended to a similar electrolytic separation of the hydrolytic cleavage products of casein, fibrin, and red blood cells, with similar results.

**Biochemistry of carotinoid pigments in animals,** L. S. PALMER (*Minnesota Sta. Rpt. 1922*, pp. 43, 44).—In continuation of the investigation of the possible significance of carotinoids in nutrition (E. S. R., 45, p. 867), the author has found that the yellow so-called lipochrome of cod liver oil is not a carotinoid and can not be removed completely by treatment with charcoal. The yellow pigment in the blood serum of pigeons has been identified as xanthophyll. The red pigment in the feet and legs of the pigeon resembles carotin in its solubility, but differs from it in other respects. When its alcoholic solutions are treated with lime water an amorphous pigment is precipitated which gives a blue color when treated with ferric chlorid instead of the green color characteristic of carotin and xanthophylls.

The examination of several cases of carotinoid skin coloration, the so-called carotinemia, has led to the conclusion that oxidation is the normal means by which the human organism rids itself of carotinoid pigments, and that carotinoid skin colorations are due in part to lowered oxidative tone of the body, as well as to a superabundance of carotinoids in the diet.

**Glucokinin.**—A new hormone present in plant tissue. **Preliminary paper,** J. B. COLLIP (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 513-543, figs. 11).—Working on the theory that, since the ability of the liver to form glycogen is intimately associated with the presence in the circulation of the pancreatic hormone insulin, the presence of glycogen in animal or plant life should also be accompanied by the occurrence of a similar enzym, the author attempted to determine the presence of such a hormone in the tissues of lower animals rich in glycogen and in *saccharomyces* and other fungi which are glycogen formers. Successful results were obtained with clam tissue and with certain extracts obtained from bakers' or brewers' yeast. Charts are presented showing the effect upon the blood sugar of normal rabbits of the injection of yeast extracts prepared in different ways. In all cases the injection was followed by marked hypoglycemia which was, however, much slower in making its appearance than in similar experiments with insulin.

With definite proof of the existence in yeast of a substance capable of producing hypoglycemia, the question was raised as to whether this substance is present in yeast simply because of the glycogen-forming property of the



yeast, or whether its function is rather the formation of  $\gamma$ -glucose. To answer this question an examination was made of the onion “(1) because the onion is a well recognized glucose burner and (2) because it is quite incapable of forming starch.”

An extract of green onion tops was found to produce in normal rabbits a definite hypoglycemia similar to that produced by yeast. Similar results were obtained with the young green leaves of sprouting wheat, green bean leaves and stems, barley roots and sprouted grain, onion roots and bulbs, and onion roots.

These results are considered to point “to the existence in the plant kingdom of a hormone somewhat analogous to that produced in the higher animals by the islet cells of the pancreas. Such a hormone in all probability plays a similar rôle in the metabolism of sugar in the plant to that played by insulin in the animal. As glycogen formation is possible in the animal as a result of the activity of the pancreatic hormone, it is possible that starch formation in the plant is, to a certain extent at least, dependent on the activity of glucokinin.”

**The propionic acid fermentation of lactose,** J. M. SHERMAN and R. H. SHAW (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 695-700).—This report is limited to a few experiments indicating the possibilities in the process of producing propionic acid from lactose by the action of the organism *Bacterium acidipropionici* (d), previously found to be concerned in the production of the characteristics peculiar to Swiss cheese (E. S. R., 45, p. 779).

On account of the slow growth and anaerobic character of this organism, an inoculum equal to 1 per cent of the material to be fermented was used and the temperature kept at 30° C. throughout. Data are first given on the course of the propionic fermentation in an unbuffered broth. These show that the growth of the organism with resulting production of acid is very slow, and that the amount of propionic acid produced is nearly twice the amount of acetic acid. After 30 days the combined weight of the propionic and acetic acids was 66.56 per cent of the weight of the sugar fermented. In the presence of a neutralizing substance the yield of acids was increased greatly. In a medium consisting of 1 per cent peptone, 2 per cent lactose, and 2 per cent carbonate, the combined yield of the two acids at the end of 30 days was 74.32 per cent of the lactose fermented. The yield could not be increased appreciably by increasing the concentration of the sugar, but the optimum concentration appeared to be about that of milk whey.

Preliminary observations that certain other organisms accelerate the activity of the propionic acid bacteria (E. S. R., 45, p. 779) were confirmed by further tests with *Lactobacillus casei* and with an unidentified culture probably belonging to the same group as *B. alcaligenes*. It was also shown that the stimulating effect of these bacteria is not due to an alteration of the lactose to a more available form.

The authors conclude that it is possible to produce propionic acid from lactose in quantities which might prove of commercial value, although the slowness of the process makes its practical utility doubtful.

**The volatile acids produced by starters and by the organisms isolated from them,** B. W. HAMMER and F. F. SHERWOOD (*Iowa Sta. Research Bul.* 80 (1923), pp. 3-15).—An examination by the barium and the Duclaux methods of the volatile acids produced by starters is reported, with a discussion of the significance of the results obtained.

The solutions of volatile acids were secured by distilling the fermented milk or cream after the addition of a small amount of  $N H_2SO_4$  to free any bound volatile acid. One liter of the distillate was used in each determination.



Of this 100 cc. was titrated with  $N/10$   $Ba(OH)_2$  with phenolphthalein as indicator to determine the amount to be added to the remaining 900 cc. of the distillate. A little less than the calculated amount of  $Ba(OH)_2$  was added, and the aqueous solution of the barium salt was concentrated to about 50 cc. on the water bath, filtered, evaporated to dryness, recrystallized, and dried at  $100^\circ C.$ , and the barium content determined quantitatively by precipitation as  $BaSO_4$ . The filtrates from the barium determinations were used for the Duclaux method, which was carried out according to the modification of Boekhout and De Vries (E. S. R., 37, p. 207), the volume of distillate being kept constant at 110 cc. and distilled at the rate of 100 cc. in about 45 minutes. The distillate was collected in 10 cc. fractions, each of which was titrated with  $N/10$   $Ba(OH)_2$  solution, using phenolphthalein as indicator. The values obtained in this and the barium salt method were compared with constants determined for pure acetic and propionic acids in the same concentration. In the Duclaux method, when the values obtained did not correspond with those of acetic or propionic acid they were considered to represent mixtures of the two in the proportion represented roughly by the closeness of the results to either the acetic or propionic values.

It is considered that while the Duclaux method is not entirely satisfactory in determining the kinds of volatile acids present in a mixture, it affords a valuable check on the barium salt method. In starters ripened for a long period the results obtained by both methods indicated that the acid produced is largely acetic, with a little propionic, while in starters which have ripened for only a short time the reverse is true. The resulting acidity of the milk treated with starters of different initial acidity also varies. At low initial acidity propionic acid may be the greater part of the acidity. The change from volatile acids giving a low barium value (acetic with much propionic) to those giving high barium values (propionic with much acetic) did not always occur, however, at the same total acidity.

A comparison of the kinds of volatile acids produced by pure cultures of the various organisms present in natural starters indicated that the different organisms produced different acids. *Streptococcus lactis* produced a volatile acidity made up of acetic, with considerable amounts of propionic, acid, while the associated organisms *S. citrovorus* and *S. paracitrovorus* produced a volatile acidity that was largely acetic.

A comparison of the volatile acids present in old cream soured naturally with those present in starters showed that the kinds of volatile acids produced during prolonged natural souring are quite different from those produced in the ripening of starters. Acids higher in the series than acetic were present in large amounts. These are thought to be partly responsible for the undesirable flavors and odors in old cream and in butter made from it.

**The destruction of pentosans by molds and other microorganisms,** E. G. SCHMIDT, W. H. PETERSON, and E. B. FRED (*Soil Sci.*, 15 (1923), No. 6, pp. 479-488).—Eight of the 25 species of mold used in a previous investigation of the fermentation of pentoses by molds (E. S. R., 48, p. 203) were selected for a similar study of the fermentation of pentosans.

Corn forage, rye straw, and finely divided wood were first used as pentosan-containing materials. About 50 per cent of the pentosans of the corn forage was destroyed within 100 days and about 35 per cent of those of rye straw in 300 days. No growth occurred in the synthetic liquid medium with wood as a source of carbon even after the addition of sucrose. The pentosans of wood were rapidly destroyed, however, when placed in a soil in which a crop was grown. In four months 69 per cent of the pentosans of poplar, 60 per cent of birch, and 47 per cent of alder were destroyed, while of the wood itself the



corresponding amounts destroyed were 61, 50, and 35 per cent, respectively, thus showing that the pentosans are more readily attacked than the cellulose, lignin, and other constituents of the wood.

That molds are apparently able to synthesize pentosans was shown by experiments in which 5 different molds were grown in culture media containing only sucrose as a source of carbon. Under these conditions about 1 per cent of pentosans developed during the course of the experiment. In similar experiments in which the carbon was furnished by xylose, a larger amount of pentosans was formed.

**Quantitative variation of gossypol and its relation to the oil content of cotton seed,** E. W. SCHWARTZ and C. L. ALSBERG (*Jour. Agr. Research* [U. S.], 25 (1923), No. 7, pp. 285-295, figs. 3).—This study, reported from the Bureau of Chemistry, U. S. D. A., deals with the maximum variation of the gossypol content of cotton seed and its correlation with the oil and protein content of the seed. The seeds examined included samples of most of the standard varieties and of the same variety obtained from different localities. From all the samples gossypol was isolated as the acetate by the method of Carruth (E. S. R., 38, p. 801) and examined crystallographically. For the quantitative determination, a modification of the anilin method of Carruth (E. S. R., 38, p. 113) was used.

The tabulated data showed variations of as much as 300 per cent in the gossypol content of the seeds examined. The lowest amount, 0.3833 per cent, was found in a 1918 sample of Lone Star cotton seed obtained in Texas and the highest, 1.1847 per cent, in Egyptian cotton seed from California. The greatest annual variation in any variety was found in Trice seeds from Bells, Tenn., the yield from the 1917, 1918, and 1919 samples being 0.5776, 0.3970, and 0.8893 per cent, respectively. In some seeds there appeared to be practically no variation from one year to another. Similarly, the same variety grown in different localities in some cases furnished practically the same amount and in others widely different quantities of gossypol. There tended to be more agreement in the content of different varieties in the same locality. "The results of all the analyses indicate that the occurrence of an intoxication due to gossypol would not be influenced by the variety of seed from which the meal is made, but rather by the place from which it came and the season in which the seed is grown. If a varietal influence upon the gossypol content actually exists, practically it is concealed. The manner of cultivation (agronometric) also probably plays a rôle."

To determine whether any significant relationship occurs between the oil, protein, and gossypol content of the seed, the correlation and partial correlation coefficients were calculated between the ether extract and nitrogen and between the gossypol and ether extract. As shown by the correlation coefficients, there appeared to be a significant relationship between the ether extract and nitrogen (the nitrogen content decreasing as the ether content increased) and between the ether extract and gossypol (the one increasing with the other). The relationship apparently existing between the nitrogen and gossypol content was shown by the partial correlation coefficient to be false.

Regionally the seeds from the Southwest tended to be low in oil, those from the Southeast somewhat higher, and those from the Pacific coast still higher. The same tendency was true of the gossypol content, and, what is considered still more significant, seeds which were atypical of the region in which they were grown, as indicated by their oil content, varied correspondingly in their gossypol content.

"These results are of interest to plant physiologists. The correlations and variations herein recorded should prove useful in attacking problems dealing with the causes which underlie variation in chemical composition. The possibility of developing a gossypol-free variety of cotton with the retention of the attribute to develop oil, which is at present correlated with the development of gossypol, should be borne in mind. The statement herein made as to the 'rule of the oil' should be interpreted to mean the simultaneous correlated appearance of gossypol and oil, and not a cause and effect phenomenon."

**A modification of the Folin-Wu method for making protein-free blood filtrates**, R. L. HADEN (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 469-471).—It is suggested that the Folin-Wu tungstic acid method for obtaining blood filtrates free from protein (E. S. R., 41, p. 13) may be simplified by substituting for the usual procedure the following technique: One volume of blood is diluted with 8 volumes of N/12 sulphuric acid. After laking is complete, 1 volume of 10 per cent sodium tungstate is added and the mixture shaken.

**A note on the Kramer-Tisdall method for the determination of calcium in small amounts of serum**, F. F. TISDALL (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 439-441).—Slight changes are described in the technique of the Kramer-Tisdall method of determining calcium in small amounts of serum (E. S. R., 46, p. 203), which are said to simplify and shorten the procedure without lessening the accuracy of the results.

**Cryoscopy of milk**, E. M. BAILEY (*Connecticut State Sta. Bul.* 248 (1923), pp. 411-415).—This is essentially the annual report of the author as associate referee on dairy products at the 1922 meeting of the Association of Official Agricultural Chemists.

A study has been made of the influence of acidity upon the freezing point depression of milk. Data on this point previously reported by J. T. Keister<sup>1</sup> and further data obtained by the author are presented. The combined data show that the effect of increased acidity upon the freezing point depression is additive and approximates 0.003° C. for each 0.01 per cent increase in acidity. In practice it is considered advisable to make a correction for acidity in the observed freezing point depression of milk which is sensibly sour, that is, which shows an acidity in excess of 0.2 per cent.

Further data on the freezing point of milk from tubercular cows confirm the conclusions drawn in the previous report (E. S. R., 47, p. 505) that the freezing points of milk from tubercular reactors are generally within normal limits. A further study of the herd whose milk was reported as giving abnormal freezing point depressions showed only one case in which the values fell outside the normal limits.

"The value of the cryoscopic method as an adjunct to present methods for detecting water is fully demonstrated by data covering a period of more than two years. Its use is unnecessary when present methods furnish conclusive evidence, but, in the opinion of the majority of experienced workers, its unique value is shown in those cases where the evidence of present methods is conflicting or inconclusive. The tentative limits for normal milk may have to be modified, but, since the value of this or any similar method is lessened as the limits of normal variation are widened, it is believed that the limiting values as already defined should remain until they can be modified more advisedly."

**The dry rendering of fats**, J. P. HARRIS (*Chem. and Metall. Engin.*, 29 (1923), No. 3, pp. 93-96, figs. 4).—A description is given of the technical process of rendering fats by the dry method, in which the fat, instead of being ren-

<sup>1</sup> Jour. Indus. and Engin. Chem., 9 (1917), No. 9, pp. 862-865.



dered with steam as in the older method, is rendered without the addition of water by heating in a steam-jacketed horizontal rendering kettle and is then separated from the cracklings by means of a shallow cone-bottomed percolator. The cracklings are fed into an Anderson expeller to remove the residual fat.

It is stated that the cracklings as thus rendered make a very high class poultry and stock feed, and that the lard produced is dry, sweet, and neutral, resembling open kettle lard more closely than the wet method lard.

**Vinegar fermentation and home production of cider vinegar, A. R. LAMB and E. WILSON** (*Iowa Sta. Bul.* 218 (1923), pp. 3-14).—The cause and prevention of difficulties in the home manufacture of cider vinegar are discussed on the basis of the results obtained in the experimental preparation of cider vinegar under conditions obtaining in its manufacture on the farm. The experimental work reported also includes a comparison of the composition of cider made from different varieties of apples and from frozen apples.

In the first season's work vinegar was made in separate lots from a number of different varieties of apples by the simple process of storing the apple juice in clean 5-gal. kegs in an unheated room, the temperature of which varied from 45 to 65° F. Samples were drawn from time to time and determinations made of volatile and fixed acidity, sugars, and alcohol. Two interesting facts were brought out by the data thus obtained. One is that the juice of frozen apples, if prepared before the apples begin to show decay, ferments very rapidly and forms a good grade of vinegar. The other point of particular interest is that the acetic fermentation begins soon after the alcoholic and the two proceed simultaneously for a time, the alcoholic fermentation being complete in about one month.

During the second and third seasons' work the experimental conditions were varied to show their effect on the fermentation. Some of the cider was stored in an unheated attic room at 50° and the rest at laboratory temperature of about 75°. Certain samples were inoculated with Fleischmann's yeast, mother of vinegar, or a pure culture of vinegar bacteria furnished by the Michigan Experiment Station. To another sample potassium phosphate and sucrose were added.

As in the first season, the variety of apple appeared to make no difference in the quality of the vinegar provided its sucrose content was not too low. The best results were secured without inoculation. This is thought to be due to the introduction of unfavorable organisms in the cultures used. Fermentation was hastened in the third season and the quality of the vinegar improved by supporting at the surface of the vinegar improvised rafts of clean oak strips to prevent the sinking of the surface film.

The practical directions which are given in conclusion emphasize as the most essential point in the successful manufacture of vinegar the use of absolutely clean apparatus and utensils from the cider press itself to the final containers in which the finished product is to be stored. A temperature of from 65 to 70° is recommended as the most favorable for successful fermentation. The barrel or container should be protected from dust and left absolutely undisturbed for 5 or 6 months, when a sample should be drawn and tested for acidity. When the acidity as acetic acid has reached from 4 to 7 per cent the vinegar should be drawn off into other barrels or containers which are filled full and corked tight.

**Making sauerkraut, H. D. LOCKLIN** (*Western Washington Sta. Bimo. Bul.*, 11 (1923), No. 4, pp. 77, 78).—Practical directions are given for the manufacture of sauerkraut on the farm.



## METEOROLOGY.

**Concerning normals, secular trends, and climatic changes,** C. F. MARVIN (*U. S. Mo. Weather Rev.*, 51 (1923), No. 8, pp. 383-390, fig. 1).—From a series of studies of the laws of sequence of weather conditions the author concludes that “the practical and useful significance of the concept ‘normal’ in weather and climatology is simply that of a convenient base number approximately equal to the average of observations over a period of, say, 50 years more or less. . . .

“The accumulated sums of departures from base and from a given epoch are most useful in exhibiting secular trends and epochal features in the data represented. . . .

“While there is no evidence indicating any permanent changes in climate, these studies demonstrate that more or less definite epochs occur from time to time when the climatic conditions of a more or less limited region suffer a material change in the value of the running average of conditions. These periods may prevail from 50 to 100 years or more, after which some other marked change occurs. Unquestionably, such features of records call for much further study and investigation. Shorter periods also are found and admit of more careful analysis because of their greater number and frequency.”

**Accuracy of areal rainfall estimates,** R. E. HORTON (*U. S. Mo. Weather Rev.*, 51 (1923), No. 7, pp. 348-353, figs. 3).—Subjecting the evidence on this point to mathematical analysis, the author concludes as follows:

“(1) A high degree of reliability may be assured even where the mean rainfall over a small area is determined from a single station, provided the station falls within the area.

“(2) It is impracticable by the use of direct averages to obtain a high degree of certainty in the estimates of rainfall over small areas with the station spacing such as now exists in the United States unless one or more stations fall within the area.

“Clearly it is also impracticable to establish and maintain a sufficient number of rainfall stations so that areal means can be determined accurately by direct arithmetic averages for all small areas.”

The author therefore submits various formulas for determining the accuracy of rainfall estimates under conditions of limited rainfall stations.

**Effect of climatic conditions on fruit trees,** H. A. PHILLIPS (*U. S. Mo. Weather Rev.*, 51 (1923), No. 7, p. 360).—The following is the author's summary of his detailed paper on this subject:

“While many factors, such as available food, abundant water supply, pruning, spraying, and tillage, contribute to successful orcharding, there is none of more relative importance than climatic conditions.

“Epochs in fruit-bearing trees are retarded in their development by an increase in altitude. According to the data the average retardation is 1 day for every 101 ft. The average rate retardation in the blooming period of fruit-bearing trees is 4.6 days for every degree of increase in latitude. The greatest retardation is through the Atlantic States, and the least through the Pacific States. Epochs are earlier westward, and the lines of full-bloom dates and the ripening dates travel in a northeast direction. In the Atlantic and the Mississippi sections the rate of retardation is not constant. This is explained by conditions affecting the rest period. From the thirty-sixth parallel southward in the Mississippi Valley and the thirty-eighth parallel southward in the Atlantic section there is very little difference in the time of the blooming period. There is much greater uniformity in the epochs in fruit-bearing trees through



the Pacific States, due primarily to the influence of the prevailing westerly winds from the Pacific Ocean.

"The ripening dates along any section travel faster than the blooming dates. The general average range of full-bloom dates at any given place is about three weeks. The number of days for the development of the ripened fruit is greater in the Pacific section than in the Atlantic and the Mississippi sections. Also the number is greater in the southern part of the Atlantic and the Mississippi sections than in the northern part.

"The peach, wherever grown, appears to be more uniform in its development than the other fruits."

**Efficiency of smoke screens as a protection from frost**, H. H. KIMBALL and B. G. MACINTIRE (*U. S. Mo. Weather Rev.*, 51 (1923), No. 8, pp. 396-399, fig. 1).—The authors' synopsis of this article is as follows:

"At Edgewood Arsenal, Md., a field was covered with dense smoke, by burning white phosphorus, on nights when conditions favored frost. The temperatures were carefully measured under and in the smoke, and also in a similar nearby field that was free from smoke. Also, the rate at which heat was radiated from a blackened surface exposed horizontally was measured both under and outside the smoke cloud.

"The results show that while the smoke cloud decreased the rate of cooling of the blackened surface about one-half, it had little effect upon the air temperature, probably because of an interchange between the air under the smoke and that outside. The slight increase in temperature noted under and in the smoke apparently was due principally to heat imparted to the air by the hot particles constituting the smoke.

"The experiments confirm previous conclusions that the most efficient and economical method of frost protection is to heat the lower layers of the air by burning some form of cheap fuel.

"The cost of maintaining a dense smoke cover over a field by burning white phosphorus, or by any other known chemical means, is greater than the cost of heating the air in the field by burning crude oil."

**Influence of Gulf water-surface temperatures on Texas weather**, I. R. TANNEHILL (*U. S. Mo. Weather Rev.*, 51 (1923), No. 7, pp. 345-347).—Data are cited to show that the temperature, rainfall, and prevailing winds of interior Texas and adjoining regions are determined to a large extent by the water-surface temperatures of the Gulf of Mexico. In view of this it is considered "highly important that the distribution of water-surface temperatures be as well known as that of the land surface."

**Monthly Weather Review** (*U. S. Mo. Weather Rev.*, 51 (1923), Nos. 7, pp. 345-381, pls. 8, figs. 8; 8, pp. 383-435, pls. 10, figs. 10).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for July and August, 1923, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 7.—Influence of Gulf Water-surface Temperatures on Texas Weather, by I. R. Tannehill (see above); Accuracy of Areal Rainfall Estimates (illus.), by R. E. Horton (see p. 114); Rainfall Duration and Intensity in India (illus.), by R. E. Horton; Are We Having Less Snowfall? by C. J. Root; The National Elimination Balloon Race from Indianapolis, Ind., July 4, 1923 (illus.), by L. T. Samuels; Lightning Fatality, by E. R. Miller; and Effect of Climatic Conditions on Fruit Trees, by H. A. Phillips (see p. 114).

No. 8.—Concerning Normals, Secular Trends, and Climatic Changes (illus.), by C. F. Marvin (see p. 114); An Improved Method of Computing Meteorological



Normals (illus.), by H. W. Clough; Hourly Precipitation at Syracuse, N. Y. (illus.), by M. R. Sanford; Efficiency of Smoke Screens as a Protection from Frost (illus.), by H. H. Kimball and B. G. MacIntire (see p. 115); Cloud Dissipated by Kite, by J. A. Riley; Forecasting Rain on the West Texas Coast, by J. P. McAuliffe; Waterspouts near Corpus Christi, Tex., by McAuliffe; The First Cool Wave of 1923 in the Dakotas and Lake Region (illus.), by A. J. Henry; and Fires Caused by Lightning in Iowa, 1919-1922, by R. N. Covert.

**Climatological data for the United States by sections** (*U. S. Dept. Agr., Weather Bur. Climat. Data, 10 (1923), Nos. 7, pp. [187], pls. 4, fig. 1; 8, pp. [187], pls. 4, fig. 1*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for July and August, 1923.

**Meteorological observations at the Massachusetts Agricultural Experiment Station**, J. E. OSTRANDER and H. H. SHEPARD (*Massachusetts Sta. Met. Buls. 417-418 (1923), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during September and October, 1923, are presented. The data are briefly discussed in general notes on the weather of each month.

**Meteorological records for 1922**, E. BURKE (*Montana Sta. Rpt. 1922, pp. 33-38*).—Data for temperature, pressure, precipitation, evaporation, sunshine, and wind at Bozeman are recorded as usual.

The mean temperature for the year was 40.1° F., 1.3° below normal, the highest temperature 90° July 3, the lowest -25° February 18. The last killing frost in spring occurred May 26, the first in autumn September 29. The total annual rainfall was 17.74 in., 1.51 in. below normal. The snowfall was 45.54 in. The number of clear days was 202.

“The relative humidity for the months of April to September, inclusive, was a trifle above normal, September being the only month with a minus humidity. . . . The months of May, June, July, August, and September show a minus monthly evaporation. Of these months July shows the greatest departure from the normal, the result of a positive precipitation and a negative average wind velocity. These months were favorable for the retention of soil moisture, which aided in reducing the amount of irrigation water necessary to produce crops. September was unusually dry and this condition, coupled with a temperature above normal, favored the rapid evaporation of soil moisture that resulted in injuring winter wheat in some sections of Gallatin Valley. The fact that the wind velocity for September was considerably below normal lessened the amount of water evaporated from the soil and saved the wheat crop from a greater loss.”

**The temperature of Mexico**, J. HERNANDEZ (*U. S. Mo. Weather Rev. Sup. 23 (1923), pp. III+24, pls. 52, figs. 5*).—Data from 70 meteorological stations are summarized and show that Mexico presents great diversity of climate, from severe cold to extreme heat, due to the highly varied topography of the country and to the proximity of the thermal equator, which in this region moves as far north as 15° N. latitude.

“In a general way it can be stated that the Republic of Mexico has three great thermal divisions:

“The hot zone (*zona calida*) encircles the country along the coasts and in addition wholly includes the Isthmus of Tehuantepec, the States of Tabasco and Campeche, and the Peninsula of Yucatan; it has a mean temperature of 22.5° C. (72.5° F.).

“The temperate zone (*zona templada*) with a mean temperature between 15° C. (59° F.) and 22.5° C. (72.5° F.) occupies an immense area stretching



from the plains of the north (llanuras) to the arable lands (campiñas) of the interior and southern regions as far as Puebla and Oaxaca. In Chiapas there is a secondary temperate zone, which undoubtedly must extend into the Republic of Guatemala. The temperatures for California (San Diego, 16° C. or 60.8° F.) lead to the inference that a small part of northwestern Lower California is included within the temperate zone.

"The cold zone (zona fria) is shown by the presence of small areas in the elevated regions of the country—one situated between the States of Zacatecas and San Luis; another comprising the valleys of Mexico, Toluca, Tula, Pachuca, Chignahuapan, and the large valley that includes the whole State of Tlaxcala and part of Puebla, and yet another in the elevated regions of Chiapas."

### SOILS—FERTILIZERS.

**Rothamsted and agricultural science**, [E.] J. RUSSELL (*Nature* [London], 111 (1923), No. 2788, pp. 466-470, figs. 2).—A brief historical account is given of the soil fertility work at the Rothamsted Experimental Station, together with a review of the principal methods used in the study of soil fertility, particular reference being made to the long-time fertilizer experiments and studies of soil physics and biology.

**Soil survey of Rockdale County, Ga.**, A. H. MEYER (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1920, pp. III+537-553, figs. 2, map 1).—This report, prepared in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 83,200 acres in north-central Georgia. It has a smooth, gently rolling to hilly topography, and the natural drainage is said to be excellent.

The upland soils of the county are of residual origin, and all of the soils are said to be well supplied with potash. They are responsive to nitrogen, phosphoric acid, and organic matter additions, however. Including meadow and rock outcrop, six soil types of two series are mapped, of which the Cecil sandy clay loam and the Appling and Cecil sandy loams cover 34.3, 29.4, and 26.6 per cent of the area, respectively.

**The physical properties of clay mud**, H. CHATLEY (*Soc. Engin. (Inc.) Trans.*, 1922, pp. 133-150, figs. 2).—Data are presented on the granulation, water content, mechanical properties, angle of friction, lateral pressure, and plasticity of clay mud, with particular reference to methods of testing and the design of structures and machinery coming in contact with mud. A classification of soils by fineness and data relating thereto are appended.

**Researches on evaporation from bare and cultivated soils**, T. WESTERMANN (*K. Vet. og Landbohøjsk. [Copenhagen], Aarsskr.* 1922, pp. 1-55, figs. 4).—Studies of evaporation from clay and sandy soils, both bare and cultivated, are reported.

Evaporation from bare sandy soils during the hot season varied from 37.7 to 117.5 per cent of the precipitation, and from bare clay soils from 50.5 to 132.8 per cent. The total evaporation and the range of variation of evaporation were less during the colder months of the year. Evaporation was always greater from the clay than from the sandy soils. Ordinarily, evaporation from bare soils was less than the total precipitation, but where vegetation began to develop evaporation became much greater.

A comparison of bare and cropped soils indicated the preponderant influence of vegetation on the consumption of moisture per unit of surface soil. The luxuriance of vegetation also exercised a marked influence upon the intensity of evaporation. Papilionaceous plants caused the greatest use of water per



unit of soil surface, followed in order by cereals and root crops. Potatoes were found to be the easiest crop to satisfy from the standpoint of water requirements.

Differences in area of foliage among different varieties of plants were found to exercise a marked influence upon evaporation. With two varieties of barley, evaporation increased progressively during the development of the plants but decreased later at the time of maturity. Experiments with oats showed that evaporation increased as the growth of oats increased in luxuriance.

**Plant physiological solution of chemical soil analysis, E. A. MITSCHERLICH ET AL.** (*Landw. Jahrb.*, 58 (1923), No. 4, pp. 601-617, figs. 6).—It is the purpose of this paper to show by means of pot studies and mathematical analysis how the available plant nutrient material in soil may be estimated on the basis of the laws governing crop growth factors.

The opinion is expressed that neither the content of nutrient material in the crop nor the amount removed from the soil by the crop can be considered a measure of the available nutrient material in soil. The estimation of available nutrient material in soil must be undertaken without consideration of the type of crop to be grown, but on the basis of physiological growth factors.

The active value of a growth factor is not constant if the factor in question undergoes changes before it is put to use by the plant. Experiments with superphosphate fertilization showed, for example, that the active value of phosphoric acid fertilization as a growth factor may be decreased as a result of the soil condition. The results of applications of the principles deduced to pot studies are taken to indicate that cropping experiments should show how great quantities of nutritive constituents are present in a test pot soil in an available form. This is considered to be a logical plant physiological basis for soil analysis.

**Method for estimating adsorbed bases in soils and the importance of these bases in soil economy, D. J. HISSINK** (*Soil Sci.*, 15 (1923), No. 4, pp. 269-276).—As a contribution from the Georgia Experiment Station, a translation by F. H. Smith of a report of studies conducted at Groningen, Netherlands, is presented, which has been previously noted from another source (*E. S. R.*, 45, p. 323).

**Laboratory method for determining the available quantities of phosphoric acid and potash in soil, H. NEUBAUER** (*Landw. Vers. Sta.* 100 (1923), No. 3-5, pp. 119-128).—Pot culture experiments with rye on washed sand and actual soil are reported, as conducted to devise a laboratory pot culture method for determining the quantities of phosphoric acid and potash in soils available to plants and the requirements of soils for these materials. The method devised is apparently based upon the amounts of these nutrient materials which young plants are able to assimilate from soils as compared with suitable standards.

**Effect of cropping upon the active potash of the soil, G. S. FRAPS** (*Jour. Assoc. Off. Agr. Chem.*, 6 (1923), No. 3, pp. 329-331).—In continuation of studies at the Texas Experiment Station on the subject (*E. S. R.*, 47, p. 26), data are briefly presented which show that the potash removed by crops in pot experiments is related to the active potash of the soil, and that there is a close relation between the potash removed from the soil and the decrease of active potash in the soil.

**Microbiological analysis of soils as an index of soil fertility.—V, Methods for the study of nitrification, S. A. WAKSMAN** (*Soil Sci.*, 15 (1923), No. 4, pp. 241-260).—In a fifth contribution from the New Jersey Experiment Sta-



tions on the subject (E. S. R., 49, p. 723), methods for the study of nitrification as a basis for comparison of the fertility of soils are dealt with.

The results indicated that nitrification of ammonium sulphate or other inorganic salts of ammonia in soils having different reactions can not be used as a basis for comparison of soil fertility. This is attributed to the fact that the amount of nitrate accumulated in the soil under laboratory conditions will depend on the initial reaction, buffer content, and final reaction of the soil more than on the bacteriological activities. It was found that nitric and sulphuric acids were formed in the oxidation of ammonium sulphate, thus increasing the H-ion concentration of the soil until a point was reached which was injurious to the activity of the nitrifying bacteria. In well buffered soils, such as those receiving large applications of organic matter, greater amounts of acid were formed before the injurious reaction was attained than in poorly buffered soils. Nitrate accumulation from ammonium sulphate in the soil stopped when the reaction reached pH 4.4 to 4.8. The greater the buffer content of the soil the greater was the amount of nitrate accumulated, even if the initial reaction was the same.

The conclusion was reached that nitrification of ammonium sulphate in the soil should be carried out, in laboratory studies, in the presence of sufficient basic material to neutralize the acids formed from the oxidation of the ammonium salt. Calcium carbonate is preferred to calcium oxid, owing to the rapid change in soil reaction brought about by the latter.

It was further found that the nitrification of dried blood, in concentrations commonly employed, is not a good test for comparing different soils. This is attributed to the different reactions involved in the transformation of dried blood, particularly in alkaline and poorly buffered soils. The opinion is expressed that either low-grade nitrogenous materials, or a low concentration of high-grade materials, should be used for the study of nitrification in soils.

It is concluded that no single method is sufficient to give a thorough idea of the nitrifying capacity of the soil and to produce a basis for comparing the nitrification of different soils, but that a combination of methods is necessary. The combination recommended includes nitrification in solution, nitrification of the soil's own nitrogen, nitrification of ammonium sulphate in the soil, nitrification of ammonium sulphate in the presence of a theoretical amount of calcium carbonate necessary to neutralize all the acid formed from the complete oxidation of the ammonium sulphate into nitric and sulphuric acid, and nitrification of organic nitrogenous materials. Details for each of the methods included in this combination are recommended, and it is stated that by giving a definite weight to the information obtained by the use of each of these five methods, a true picture of nitrification in soil may be obtained.

**The influence of nitrogen in soil on azofication,** J. E. GREAVES and D. H. NELSON (*Utah Sta. Bul.* 185 (1923), pp. 3-23).—Laboratory and pot studies on the influence of various carbohydrates, dried blood, and different nitrates upon the nitrogen equilibrium of a highly calcareous soil, well supplied with all the essential plant nutrients except nitrogen, are reported. Field studies of the loss or gain of nitrogen in soil receiving various quantities of manure and water are also reported.

The addition of mannite alone decreased the nitrogen-fixing powers of this soil, but when applied in connection with 0.084 per cent of sodium, calcium, magnesium, or manganese nitrates it increased the nitrogen-fixing powers. Two per cent of dried blood when applied to the soil increased its nitrogen-fixing powers, but when applied in conjunction with 0.084 per cent of the various nitrates there was a loss of nitrogen.



In pot experiments mannite and lactose increased the nitrogen-fixing powers of the soil. Dried blood or nitrate caused a loss, the extent of which was frequently decreased by the application of mannite or lactose, probably due to an increased bacterial flora which fed upon the rapidly formed ammonia, thus preventing its volatilization.

Annual applications of 5 and 15 tons of manure to this soil over a period of 11 years very materially increased its nitrogen-fixing powers. The total increase was greatest where 15 tons of manure were used, but the increase per ton of manure was greatest where 5 tons were used. The application of irrigation water to this soil increased its nitrogen-fixing powers up until 20 in. a year were applied. Above this there was a small decrease.

The percentages of distribution of the total nitrogen in the first, second, and third feet were 41, 33, and 26, respectively. This was only slightly modified by the application of manure or water, thus showing that the nitrogen applied in manure is distributed throughout the surface-foot sections in the same proportions as is the original nitrogen of the soil.

A bibliography is appended.

**Effect of humus in small and large additions on the fixation of nitrogen by *Azotobacter chroococcum*, J. VOICU** (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 20, pp. 1421-1423).—Studies on the influence of a humus preparation on the fixation of nitrogen in liquid medium by *A. chroococcum*, when added in small amounts at rates of from 0.1 to 5 mg. per 100 cc. of medium and in large amounts at rates of from 100 to 200 mg. per 100 cc., are reported. The humus preparation used contained 3.22 per cent of nitrogen and 2.6 per cent of ash.

The favorable influence of the humus was evident when added in an amount as small as 0.5 per cent. When 1 per cent was added the nitrogen fixation was almost doubled, and when 5 per cent was added the nitrogen fixation was more than tripled. Where the small additions of humus were made the quantity of nitrogen fixed per gram of sugar consumed in the medium was practically constant, but where the large additions were made there was quite a marked increase in nitrogen fixation per gram of sugar consumed.

[**Soil fertility investigations at the Minnesota Station**], F. J. ALWAY, C. G. SELVIG, P. E. MILLER, O. I. BERGH, M. J. THOMPSON, and R. E. HODGSON (*Minnesota Sta. Rpt. 1922*, pp. 103-106, 117, 118, 125-129, 137, 138, 144-146, 150, fig. 1).—The progress results of fertilizer and soil management experiments at the central station and the different substations are summarized in this report.

Cooperative trials of treble superphosphate on more than 400 farms distributed over the State are said to have indicated the beneficial effect of this material with small grains on freshly broken, black sandy loam with naturally poor drainage and with clover on well-drained black silt loam soil. Experiments on the management of peat and sandy soils are also briefly described.

**Crookston Substation**.—Experiments covering eight years demonstrated the value of acid phosphate for wheat, red clover, and sweet clover. Neither rock nor acid phosphates alone or in combination with manure increased the yield of corn or oats. Experiments covering eight years with potash, acid phosphate, and nitrogen used alone and in different combinations on a rotation of barley, clover, and corn showed the superiority of a combination of acid phosphate and potassium sulphate for corn, of phosphate for barley, and of potash and phosphate for clover hay.

Rate of manuring tests demonstrated the superiority of the 4-ton application to all crops with reference to increase per ton of manure. The largest yields in a 4-year rotation of corn and potatoes, wheat, clover, and oats were obtained, however, with 16 tons applied on oats and wheat stubble for corn.



with 32 tons for corn stover, with 16 tons for wheat, with 4 tons for wheat straw, and with 32 tons for oats.

A comparison of applications of 1 and 2 tons of straw and of 2 tons of straw burned on corn and wheat demonstrated the superiority of the burned straw for corn.

*Morris Substation.*—Phosphate fertilizer and manuring experiments on a rotation of corn, wheat, oats, and clover indicated an almost uninterrupted record for seven years of the value of acid phosphate for wheat and oats. Rock phosphate apparently had little influence on crop yield. Combinations of either acid phosphate or rock phosphate consistently gave the highest yields of corn, little difference being evident between the two phosphates when used with manure. Either acid phosphate or rock phosphate alone or in combination with barnyard manure increased the clover yield.

Fertilizer tests with alfalfa begun in 1915, using several different fertilizers and combinations thereof, showed that so far the increases due to fertilizers, with the exception of acid phosphate and manure, are too small to warrant their use with alfalfa.

Rate of manuring experiments begun in 1916, in which applications up to 32 tons per acre were tested on a rotation of corn, wheat, barley, and clover, and timothy, indicated that the heavier applications are apparently impracticable for any of the crops.

Experiments begun in 1916 on the use of wheat straw and corn stover as fertilizer at rates of 1 and 2 tons per acre on a 2-year rotation of corn and wheat showed that for a 6-year average the 1-ton application of straw gave slightly higher yields of corn than the 2-ton application. Very slight differences were noted with wheat following corn stover with either the 1- or 2-ton applications, although a 6-year average seemed to favor the 2-ton application.

*Grand Rapids Substation.*—Field experiments on the use of phosphates, nitrates, and potash singly and in mixtures on various crops are said to have indicated the superiority of the potash. The beneficial effect of the nitrates was marked when applied in combination with potash, but was less so when used alone. Stable manure showed markedly beneficial effects.

*Duluth Substation.*—Phosphate-manure, clover utilization, rotation without clover or manure, rate of manuring, and other fertility experiments have shown that neither rock nor acid phosphates have yielded sufficient returns to justify their purchase, that pasturing off clover is the most effective means of its utilization from the standpoint of soil fertility, and that the smaller applications of manure are the most effective.

*Waseca Substation.*—Tests of the value of raw rock phosphate, acid phosphate, and manure on corn, wheat, oats, and barley are said to have indicated that the application of manure at the rate of 8 tons per acre once in four years is profitable. Acid phosphate was practically equal to manure and was especially valuable in increasing the yields of clover hay. The effect of the acid phosphate has increased progressively.

Is the policy of using mixed fertilizers in general farming sound? F. E. BEAB (*Amer. Fert.*, 58 (1923), No. 13, pp. 50-52, 57, 58, fig. 1).—In a contribution from the College of Agriculture of the Ohio State University, data from studies conducted at the Ohio Experiment Station are summarized, from which the conclusion is considered justified that there is some optimum ratio of nitrogen, phosphoric acid, and potash which will fit the needs of each crop under given soil and climatic conditions. With this in view, the author appears favorable to the use of a proper range of mixed high-analysis fertilizers.



**Nitrogen fertilization experiments on green lands**, R. HOFFMANN (*Landw. Jahrb.*, 58 (1923), No. 4, pp. 567-600).—Nitrogen fertilization experiments on meadow and pasture lands are reported.

These showed that the hay yield in weight per unit area of soil was a logarithmic function of the amount of ammonium sulphate added per unit area of soil. The hay yields corresponded to the equation

$$\log (A-y) = \log A - 0.025 (x+z)$$

in which  $A$  is maximum yield,  $y$  is average yield,  $x$  is the amount of ammonium sulphate added to the soil per unit area, and  $z$  is the amount of nitrogen in the soil corresponding in activity to that of ammonium sulphate.

The active value of the ammonium sulphate was found to conform to the comparative action factor 0.025 in all cases independently of climate, soil, and kind of plant. The timothy soil was richest in nitrogen, corresponding in activity to that of ammonium sulphate. The nitrogen content of pasture soil was found to be considerably less, while swamp meadow contained only slightly more nitrogen than pasture soil. These results are taken to explain the marked and regular nitrogen action of the mineral meadow soils of Germany. Nitrogen fertilization caused a marked increase in the growth of grasses over clovers, especially on timothy meadows.

**Origin of the Chilean nitrate beds**, J. STOKLASA (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 22, pp. 1570-1573).—Data are presented to show that the Chilean nitrate deposits are of volcanic and not organic origin.

Analyses of volcanic materials are presented showing that they are somewhat similar in composition to the Chilean nitrate deposits, that they are especially rich in ammonium salts, and that they are radioactive. The nitrification of these ammonium salts is quite rapid and complete under the influence of radioactivity. The superior effectiveness of Chilean nitrate as a fertilizer over synthetic and other nitrates is ascribed to its radioactivity.

**Production of sulphate of ammonia in 1922**, C. G. ATWATER (*Amer. Fert.*, 58 (1923), No. 12, pp. 23-28, figs. 2).—Data on production, export, and import of ammonium sulphate in the United States and European countries are summarized and discussed in this report. It is shown that the production of ammonium sulphate and equivalent materials in the United States during 1922 was 522,000 tons, which was considerably greater than the production in 1921. Germany was the greatest producer of ammonium sulphate during the year.

**Guide to grassland experiments in Essex** (London: Min. Agr. and Fisheries, 1923, pp. 16).—The details of experiments begun in 1915, conducted by G. S. Robertson for the East Anglian Institute of Agriculture, Chelmsford, to study the influence of high-grade basic slags, new open hearth basic slags, and ground mineral phosphates on poor grasslands, are described.

The results indicate that, while the returns from various open hearth basic slags are somewhat erratic when compared with those obtained from basic slags of high citrate solubility, they have in every case given highly profitable returns. In each experiment the open hearth basic slag of 45 per cent solubility proved to be strictly comparable with the highest citrate-soluble types of basic slag. On the other hand open hearth slags with solubilities of from 20 to 0 per cent did not do as well. On soils well supplied with calcium carbonate the low citrate-soluble phosphates did as well as the high citrate-soluble basic slags in the wetter seasons, but not so well during the drier seasons. On acid soils low citrate-soluble phosphates appeared to do quite as well as the high citrate-soluble phosphates in both dry and wet seasons. Basic slag had a marked influence in increasing the proportion of clovers in grasslands.



The results of all the experiments agreed in showing that rock phosphates have a much higher mineral value than has hitherto been admitted. On sour soils and where the rainfall was high a certain amount of evidence was obtained which suggests that under such conditions they may even prove superior to the best grades of basic slag. Even under conditions favoring high solubility, their value for the manuring of grasslands was very close to that of highly soluble basic slag, in that they produced exactly the same type of improvement in the quality of the hay crop and the pasture. In every experiment they proved to be more effective than the open hearth fluorspar slags. Gafsa phosphate seemed to be the most suitable of the rock phosphates for direct application. On sweet soils or where the rainfall was low the more soluble types of North African phosphates, such as Gafsa, Egyptian, Algerian, and Tunisian phosphates, appeared to be superior to the less soluble and harder types, such as Florida pebble.

**Potash from seaweed in California**, A. W. ALLEN (*Chem. and Metallurg. Engin.*, 29 (1923), No. 2, pp. 49-52, figs. 9).—The author presents a brief history of the kelp industry and discusses refinements in processing, practices in Scotland and California, and the prospects of rehabilitating the industry.

**The air slaking of lime**, F. H. RHODES, W. H. JONES, and W. R. DOUGAN (*Chem. and Metallurg. Engin.*, 28 (1923), No. 24, pp. 1066-1069, figs. 5).—In a contribution from Cornell University, studies on the rate and manner of deterioration of siliceous, magnesium, and high-calcium limes when exposed to air are reported.

The results showed that in the slaking of lime in air the essential reactions are the absorption of moisture with the formation of calcium hydroxid, and the absorption of carbon dioxid with the formation of calcium carbonate. Hydration took place much more rapidly than carbonation in the relatively pure high-calcium limes. The amount of water actually taken up by the lime was greater than that theoretically required to convert the oxid into hydroxid. It is thought that the excess water is absorbed on the surface of the particles of hydroxid and carbonate.

The percentage of so-called active calcium oxid in the material decreased very rapidly as hydration and carbonation proceeded, being much greater than would be expected from the amount of water and carbon dioxid absorbed during slaking. This abnormal decrease in active calcium oxid is attributed to crystallization of the very reactive amorphous hydrate and the formation of relatively inert crystalline hydrate. It was noted, however, that the slaking was accompanied by an increase in weight, so that the decrease in the weight of available calcium in the partially slaked lime from a given original portion of quicklime was considerably less than the decrease in the percentage of available calcium oxid. There was a more regular and more gradual increase in the percentages of water and carbon dioxid in the magnesium limes, and a more uniform and less rapid decrease in the active calcium oxid. Some siliceous limes acted very much like pure high-calcium limes, while others acted very much like magnesium limes.

**Uses of lime on the farm**, J. A. SLIPHER (*Natl. Lime Assoc. Bul.* 176 [1923], pp. 36, figs. 42).—A large amount of practical data relating to the use of lime on the farm is summarized in this bulletin.

**Sulphur and soil acidity**, W. A. DE LONG (*Sci. Agr.*, 3 (1923), No. 10, pp. 354-356).—Field and laboratory studies conducted at the Nova Scotia Agricultural College on the influence of sulphur on soil acidity are reported.



These showed a marked increase of acidity in all soils to which sulphur was added. The amount of acidity produced increased quite regularly with the amount of sulphur added up to 500 lbs. per acre, beyond which amount an increase sometimes did and sometimes did not produce an increase in acidity. The uninoculated sulphur produced as great acidity as the inoculated sulphur, and the maximum lime requirement was obtained in every case at the second test, or about eight weeks after planting potatoes.

The conclusion is drawn that the increase of acidity as indicated by increased lime requirement was due, directly or indirectly, to the sulphur added. Chemical discussion of these results, however, brought out the fact that oxidation of the sulphur added could not in any case account for all of the acidity produced. The possibility is suggested that sulphur oxidation may have had some effect upon the bacterial population of the soil and its activities which would tend to produce acidity. Further studies are in progress to cover this point.

**Recovery of nitrogen from sewage in the activated sludge process, E. ARDEEN, C. JEPSON, and P. GAUNT** (*Jour. Soc. Chem. Indus.*, 43 (1923), No. 21, pp. 230T-234T).—Investigations on the proportion of the nitrogen content of sewage which may be recovered in the resultant sludge when treated by the activated sludge process, and on the source of the recovery of nitrogen, are reported. The investigations included both laboratory experiments and results obtained in the normal operation of an activated sludge plant. A purely domestic sewage well below average strength was used in the laboratory studies, and the experiments were conducted on the fill-and-draw method of operation.

The results showed that there is usually some loss of the total sewage nitrogen during treatment by the activated sludge process. The extent of the actual loss was found to depend on the method of applying the process. Operating on the fill-and-draw method gave rise to greater actual losses of nitrogen and less recovery of nitrogen in the resultant sludge than when the process was worked on the continuous-flow system. Apparently the recovery of sewage nitrogen in the effluent and resultant sludge was most nearly quantitative in the absence of vigorous nitrification.

It was found that, apart from the actual method of operation, the proportion of the total sewage nitrogen lost and of that recovered in the sludge is liable to vary quite considerably. This variation is attributed to the changeable biological condition of the sludge, which in turn is controlled by the character of the sewage treated and the adequacy, or otherwise, of the means and period of aeration. The nitrogen recovered in the sludge in excess of that contained in the gross suspended sewage solids is attributed mainly to the flocculation of the sewage colloids. Fixation of atmospheric nitrogen was found to play no significant part, if any, in the increased nitrogen content of activated sludge. No evidence was obtained that the increase in nitrogen content of the sludge is due to the absorption and fixation of soluble ammonium salts. It is concluded that the high nitrogen content of activated sludge may be accounted for mainly by the flocculation of the sewage colloids, and secondly by the growth of bacteria and higher organisms.

**Commercial fertilizers, 1921: Report of inspection work [West Virginia], B. H. HITE** (*W. Va. Dept. Agr. Bul.* 55 (1922), pp. 47).—Actual analyses and guaranties of 301 samples of fertilizers and fertilizer materials collected for inspection in West Virginia during 1921 are reported in this bulletin, together with the text of the State fertilizer inspection law. The analyses indicate that only a very few brands failed to come up to the guaranties.



**Fertilizer materials employed in agriculture** (*Materias Fertilizantes Empleadas en la Agricultura*. Madrid: Min. Fomento, Dir. Gen. Agr., Minas y Montes, Junta Consultiva Agron., 1921, pp. 611).—A large amount of data on the total consumption, cost, and use of fertilizers and fertilizer materials in the different provinces of Spain in 1919 is brought together, with information on the commercial fertilizer industry in Spain.

## AGRICULTURAL BOTANY.

**Studies in plant metabolism and growth**, L. I. KNIGHT and C. L. FARABAUGH (*Minnesota Sta. Rpt.* 1922, pp. 101, 102).—Studies on the rest period of roots of rhubarb and dahlia and tubers of the Jerusalem artichoke are said to indicate a considerable increase in yield in winter forcing from the use of forcing agents, especially ether. In connection with studies of dormancy in fruit trees, evidence was obtained indicating the migration of certain salts into the growth regions.

**The contributions of seeds to the adult plant**, H. COUPIN (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 15, pp. 597–600).—The contribution of seed to adult plant, as illustrated, may be considerable or (mostly) very small. The service rendered seems, up to a certain point only, dependent rather upon the seed volume than upon the nature of the reserve material furnished. In the adult plant, the seed contribution appears to depend rather upon what is called the temperature or constitution of the plant and its systematic position, though notable exceptions are abundant.

Seed reserves may, it is said, contribute to the upbuilding of root, hypocotyl, stem, and leaf, but not of the flower.

**The chemical and physico-chemical properties of plant tissue fluids**, R. A. GORTNER, W. F. HOFFMAN, and R. NEWTON (*Minnesota Sta. Rpt.* 1922, pp. 44, 45).—In connection with this investigation a new method has been devised for the rapid and accurate determination of the moisture content of expressed plant saps, making use of the refractive index of the sap. It is claimed that it is possible to determine the total solids in two or three drops of sap within two minutes' time. A method has also been devised for the determination of the relative amount of hydrophilic colloids in a plant sap.

**Cytological observations on the bud of *Elodea canadensis***, A. GUILLIERMOND (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 5, pp. 331–333).—Observations indicated are said to show the existence in plant cell cytoplasm of two categories of elements, the one easily visible in plants responding feebly to mitochondrial (coloring) methods and consisting of lipid granulations, products of metabolism improperly designated as microsomes; the other, difficultly visible during life though clearly defined by their microchemical characters, colorable by mitochondrial methods only and constituting the mitochondria.

**The influence of temperature in the utilization of glucose in the development of *Aspergillus niger***, E. F. TERROINE and R. WURMSER (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 11, pp. 482, 483).—The ratio of utilization of glucose by *A. niger* varied in no regular and definite way from the constant 0.44 as approximated for the temperatures 22, 29, and 38° C. in these or in other experiments noted.

**Effect of low temperature on plants**, R. B. HARVEY and L. O. REGEIMBAL (*Minnesota Sta. Rpt.* 1922, p. 102).—The authors report that by the use of a simple laboratory method for testing the freezing points and killing points of buds and twigs they are able to determine the hardiness of plums, apples, or other fruits in from one to two years after crossing instead of having to wait for a number of years, depending upon the variations in the weather.



Determinations by the thermocouple method on shrubs and trees are said to indicate that during the autumn the killing point gradually falls until the lowest points are reached in December, when they remain fairly constant. Some work was done on the freezing point of corn kernels and stalks during the time of ripening, and it was found that when the ripening had gone far enough to reduce the moisture content below 30 per cent, the freezing point was lowered very rapidly. The thermocouple method has also given interesting results in determining the hardening effect of the sun's rays on the bark of trees, especially in relation to the cause of sun scald in winter.

**Moisture relations of peach buds during winter and spring**, E. S. JOHNSTON (*Maryland Sta. Bul.* 255 (1923), pp. 59-86, figs. 9).—As a contribution to winter hardiness the author made a study of the moisture index of peach buds, by which is meant the ratio of moisture content to dry weight. The moisture indexes of three varieties of peaches studied in 1921-22 showed low winter values with increasingly high spring values. The values throughout most of the winter and spring were highest for the variety Late Crawford and lowest for Greensboro, with Elberta intermediate. This index is considered to be correlated with bud hardiness in these three varieties, the higher the index the less hardy the variety.

An apparent correlation was indicated between the moisture index in spring and the temperature of incipient ice formation within the buds when artificially cooled in the laboratory.

Fruit buds were found to depend directly on the roots of the trees for their moisture in early autumn, while during the winter season the tree served as an adequate source of water. The rate of increase in the moisture index after January 1 was found to vary on five different years as the sum of the effective daily mean temperatures above 43° F. Certain influences, such as the amount and distribution of rainfall, are believed to predetermine the exact relationship between air temperature and the moisture index of the buds for the period following dormancy.

**Growth of plants in artificial light**, R. B. HARVEY (*Minnesota Sta. Rpt.* 1922, p. 103).—A brief account is given of experiments previously noted (E. S. R., 48, p. 26). The plants were grown in artificial light entirely, from seed germination to the production of seed during the winter season. The method was not found to be excessively expensive. The light was left on continuously, and the time required to ripen fruit in artificial light was considerably shorter than that required out of doors in summer. None of the plants tested seemed to require a certain period of illumination to cause them to bloom.

**Respiration of leaves in vacuum or in scant oxygen**, L. MAQUENNE and E. DEMOUSSY (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 7, pp. 373-377).—Studies described in some detail are supposed to justify the conclusion that so-called intracellular respiration and normal respiration, to which certain authors have ascribed a common origin, proceed really from different causes and should both be regarded as autonomous functions as truly in their intimate mechanism as in the influence they exert upon the life of green plants.

**The condition of chlorophyll in plastids**, V. LUBIMENKO (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 6, pp. 365-367).—As the result of work done in Petrograd in 1921 with *Aspidistra elatior*, the pigment of which may be completely extracted with water, the conclusion is reached that the chlorophyll is intimately held to protein substances of the plastids and that this junction is probably chemical as to its nature. It appears probable also that chloroplasts of normal green color contain only one green pigment, which decomposes very easily under the action of all those reagents which favor coagulation of



protein substances and which alter them only. This decomposition of the natural pigment becomes evident by a greater or less change of optical qualities and of absorption spectra. The chlorophylls *a* and *b* are supposedly derivatives of one primitive green substance, which is probably not the same for all green plants. Researches show different species to vary greatly as regards living leaf absorption spectra, and it is considered as very probable that optical variations are due to chemical variations in the protein substances to which the green pigment is attached.

**Formation of anthocyan in flowers of *Cobaea scandens* at the expense of preexisting glucosids,** ST. JONESCO (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 19, pp. 850-852).—In a report of studies testing phases of the work of Rosé (E. S. R., 33, p. 427) so far as it supported that of Combes (E. S. R., 22, p. 132), the author criticizes certain conclusions of Rosé, citing work by Noack (E. S. R., 42, p. 129) as effecting the extraction and study of a brown pigment, which the present author has succeeded in transforming by oxidation into violet red pigment by a method indicated.

**Free anthocyanidins in fruits of *Ruscus aculeatus* and *Solanum dulcamara*,** ST. JONESCO (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 3, pp. 168-171).—Studies still in progress have shown that a reddish violet pigment, here noted, indicates the presence of anthocyanidins existing in the free condition in *R. aculeatus* and *S. dulcamara*. These anthocyanidins exist along with the anthocyanins in the mixture of pigments giving red color to fruits.

**Free anthocyanidins in red flowers and leaves of some plants,** ST. JONESCO (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 8, pp. 426-429).—Having indicated in the account noted above the presence of anthocyanidins in plant organs other than fruits, the author demonstrates in the present note the existence of those substances in flowers of *Pelargonium* and *Papaver rhoeas* and in red or olive green leaves of *Prunus pissardi*.

Briefly stated, there exist in various red organs of plants free anthocyanids as coloring pigment. It is considered as possible that these substances arise along with the other pigments, but as more probable that they originate in the hydrolysis undergone by anthocyan in the course of its disappearance as such. In any case the coexistence of anthocyanins, anthocyanidins, and pseudo bases in the same organ shows that these substances have among themselves relations closely connected with the disappearance of red pigment in plants.

**Mobile starch and geotropism,** E. ZAEFFEL (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 9, pp. 442-445).—Studies on geotropism and related conditions and changes in oat plants are outlined, with resulting views.

In plants, living cells having mobile starch resting against a protoplasmic cell wall, a semipermeable membrane with amylase and with reducing sugars, constitute among themselves, and also between themselves and neighboring cells deprived of mobile starch, a grouping of osmometers which are in a state of dynamic equilibrium in case of every organ when oriented in its normal position. When an organ, as for example, a stem or main branch, is placed horizontally, the mobile starch grains, falling upon the now horizontally placed longitudinal walls, determine certain modifications in the osmotic relations between different cells, and the turgescence becomes modified by a new distribution of water, this new apportionment determining in the organ in question deformations which may result in geotropic curvature.

**Curvilinear growth in plants,** H. RICOME (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 15, pp. 595-597).—Factors influencing direction of growth in certain plants are outlined, with more particular reference to the part played by water.

**The causes of inverse orientation in root and stem**, H. RICOME (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 3, pp. 167, 168).—Previous conclusions (E. S. R., 45, p. 31) are confirmed by the studies here noted and other facts established recently, and the author's views regarding the mechanism of orientation during growth are outlined.

**The distribution of iron in plants**, L. MAQUENNE and R. CERIGHELLI (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 5, pp. 273-278).—The present communication relates to studies on iron in plants, analogous to those previously reported by Maquenne and Demoussy (E. S. R., 45, p. 29).

It is stated that the conclusions previously announced for copper apply without restriction to iron, this metal being capable of replacing copper in connection with organic activity and with reproduction. It is thought that copper may prove to be as useful as iron in the economy of plant life.

## GENETICS.

**Inheritance in swine**, H. NACHTSHEIM (*Ztschr. Schweinezeitung*, 29 (1922), No. 5, pp. 65-71, figs. 2; also in *Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 13 (1922), No. 11, pp. 1366, 1367).—Attention is called to the adaptability of swine for use in experiments in the study of heredity, and reference is made to certain characters of economic importance which might be studied.

**Biometrical methods**, W. R. WILLETT (*Penn State Farmer*, 16 (1923), No. 9, pp. 228, 229, figs. 2).—The purposes of biometrical studies are briefly summarized, and a popular explanation is given of the method of calculating mean, standard deviation, and probable errors by Bessel's and Student's formulas.

**A review of the present position of the analysis of heredity in poultry**, P. HERTWIG (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 30 (1922), No. 3, pp. 183-254).—This is an extensive review of the literature dealing with the inheritance of characters in poultry, compiled at the Institute for Hereditary Research at the Agricultural High School, Berlin. The work consists largely of discussions of the factors determining pigments in the feathers, skin, iris, feet, beak, and eggshell; feather form and growth; amount of feathering; comb form; form of the skeleton; syndactylism; egg production and broodiness; body weight; and sex determination and associated characters. The bibliography consists of 165 references.

**Unusual color inheritance**, G. S. TEMPLETON (*Jour. Heredity*, 14 (1923), No. 1, pp. 39, 40, fig. 1).—An account is given of a crossbred Angus-Hereford steer at the Texas Experiment Station which was red instead of black as usually occurs. Though the sire, which was a registered Angus bull, had never sired a red calf in 35 matings with Angus cows, 1 mating with a grade shorthorn, and 3 matings with grade Jerseys, it is concluded that he must have been heterozygous for coat color.

**Colors of Shorthorn cattle**, R. W. DUCK (*Jour. Heredity*, 14 (1923), No. 2, pp. 65-85, figs. 7).—A study at Syracuse University of the herdbook records of the color of the sires and dams of 11,685 registered Shorthorn cattle has led the author to conclude that color in Shorthorn cattle is due to two factors and their allelomorphs designated by the symbols R, E, r, and e. RR determines red and rr white. The heterozygous condition determines roan or red and white in the presence of E or e, respectively. An animal RrEe is usually partly roan and partly red and white and might be classed as either in the herdbook. It is thought that many errors in recording colors in the herdbooks undoubtedly occur.



**Inheritance of dwarfing in maize**, J. H. KEMPTON (*Jour. Agr. Research* [U. S.], 25 (1923), No. 7, pp. 297-322, pls. 5, figs. 9).—Brachytic (E. S. R., 44, p. 734) and dwarf are described in this contribution from the Bureau of Plant Industry, U. S. D. A., as two forms of dwarf maize in which the reduced stature is due to shortened and not to a smaller number of internodes. The dwarf variation also departs from normal in its shortened and widened leaves, reduced number of tassel branches, and perfect flowered ears.

F<sub>1</sub> plants from dwarf×brachytic are as tall as normal plants from which the brachytic variation arose, and are normal with respect to the other teratological characters. In the perjugate generation, as regards stature, normal, brachytic, and dwarf plants occur in the ratio of 9:3:4, indicating that the double recessive, a combination of dwarf and brachytic, closely resembles the dwarf parent. This indication is confirmed when self-pollinated seed of segregated brachytic plants is grown. From their behavior, dwarf and brachytic appear to be two independent variations, both expressed in reduced stature, the genes for which are located in separate chromosomes.

Analysis of the plants of the F<sub>2</sub> with respect to all characters differentiating dwarf plants from the other groups shows that the complex of characters associated in the dwarf variation is not inherited invariably as a unit. From a consideration of the general features of such variations as anther ear, dwarf, and brachytic it is suggested that in maize, at least several and possibly all the chromosomes are identical, each having a complete assortment of genes for all the characters arranged in a similar order. Such a condition would arise through a reduplication of the chromosome number similar to that observed by Blakeslee (E. S. R., 47, p. 524) in *Datura*. The recurrence of degenerative variations is discussed, and the hypothesis is advanced that the survival of such stocks is due to the linkage relations of deleterious characters with factors favorable for growth.

**Resistance in rye to leaf rust, *Puccinia dispersa***, E. B. MAINS and C. E. LEIGHTY (*Jour. Agr. Research* [U. S.], 25 (1923), No. 5, pp. 243-252, pls. 2).—Studies of 68 selections and varieties of rye have shown that in some cases there is high resistance to and in others practically complete immunity from the leaf rust of rye (*P. dispersa*). None of the varieties or selections were uniformly resistant, but all of the varieties or selections showed a few individuals having high resistance.

The production of susceptible individuals from a cross between resistant ones is said to indicate that resistance is probably dominant, but the production of intermediate types is considered to indicate complicating factors.

**Crossing over and the theory that the genes are arranged in the chromosomes in serial order**, H. S. JENNINGS (*Natl. Acad. Sci. Proc.*, 9 (1923), No. 5, pp. 141-147).—Formulas are suggested for computing crossover ratios when interference is and is not present. The crossover ratios for various extents of interference were determined and compared with those found in nature.

**Some consequences of different extents of interference in the crossing over of the genes**, H. S. JENNINGS (*Natl. Acad. Sci. Proc.*, 9 (1923), No. 5, pp. 147-149, fig. 1).—Using the formulas from the above paper, the author shows how the amount of crossing over when there is interference would oscillate above and below 50 per cent for high crossover percentages as the distance between the genes increases.

**Genetic variation in linkage values**, J. A. DETLEFSEN and L. S. CLEMENTE (*Natl. Acad. Sci. Proc.*, 9 (1923), No. 5, pp. 149-156).—This is largely a discussion of the factors affecting crossing over and the results of selection experiments to reduce crossing over.



Crossing over in certain regions of the chromosomes has shown that factors are apparently operating to reduce it (E. S. R., 45, p. 370). The crossover values of the  $F_1$  and  $F_2$  generations from a mating between low crossover stock and normal are tabulated. In these crosses four and five different characters are considered. The  $F_1$ s showed 17.7 per cent, 31.3, 39.9, and 69.7 per cent, respectively, of the normal amount of crossing over in four different regions. The  $F_2$  values were in all cases consistently higher than the  $F_1$ s, indicating a partial dominance of the factors determining a low crossover percentage.

**Studies in intersexuality.**—I, A peculiar type of development intersexuality in the male of the domesticated mammals, F. A. E. CREW (*Roy. Soc. [London] Proc., Ser. B*, 95 (1923), No. B 665 pp. 90–109, figs. 12).—The author has examined 35 cases of animals possessing characteristics of both sexes at the animal breeding department of the University of Edinburgh. The animals examined were 25 goats, 7 pigs, 2 horses, 1 bull, and 1 sheep. The anatomy of the genital organs of 4 of the cases in pigs, 4 in goats, and 1 in cattle are described and diagrammed. All cases were very similar in general, and are described by the author, as follows:

“The external genitalia in a few cases had the form of an unremarkable vulva and clitoris, in others the erectile organ was abnormally large though female in type, in others it was peniform but imperfectly canaliculized. In no instance was there a typical scrotum, though in several the gonads could be palpated beneath the skin of the inguinal or perineal regions. The internal genitalia in all cases consisted of paired testes, with a histological structure varying with the position of the organ, and situated somewhere along the line between the primitive position and the imperfect scrotum and a double set of structures of the accessory sexual apparatus. The relative degree of development of the structures derived from the Wolffian and Müllerian ducts, respectively, varied in different cases. The secondary sexual characters were imperfectly male in some cases, though definitely male in all.”

The author discusses the process of sex differentiation in the embryonic development of animals and the conclusions of Goldschmidt on intersexuality in moths, from which he concludes that the explanation of the cases described is that these individuals are males in which the differentiation of the sex has been abnormal. It is suggested that the early determination of sex may depend upon the amount of sex differentiating stimulant secreted by the endocrine organs. The differentiation of the different sex characters of a zygotic male are divided into three overlapping periods, (1) the atrophy of the Müllerian ducts, (2) the further development of the accessory sexual apparatus, and (3) the modeling of the external genitalia. When sufficient sex differentiating stimulus is present for normal sex development during the first period, a normal individual is produced, but when less than a minimum amount is available during the first period certain sex characters will be deficient, depending upon the degree in which the sex differentiating stimulus is lacking. As the animal matures the minimal amount of sex differentiating stimulus will be produced which will result in a normal development of secondary sex characters, though some primary sex characters are improperly developed.

**Breeding experiments on the inheritance of acquired characters**, P. KAMMERER (*Nature [London]*, 111 (1923), No. 2793, pp. 637–640).—A brief review is given of several experiments with salamanders, frogs, and ascidians (*Ciona intestinalis*) carried on during the past 25 years by the author, which tend to substantiate the possibility of the inheritance of acquired characters.

**Sterility studies in fruit breeding**, J. H. BEAUMONT and A. N. WILCOX (*Minnesota Sta. Rpt.* 1922, pp. 88, 89).—It is reported that interspecific crosses



of *Prunus nigra*, *P. triflora*, *P. americana*, and their reciprocals are more fertile than are crosses among the progeny of an interspecific cross. Pollen tube measurements of the styles of the various crosses are said to indicate that both self-sterility and cross sterility may be accounted for by the lack of a proper stimulation both for germination of the pollen on the stigma and for the growth of the tube in the style. Germination and growth tests of apple pollen in artificial media are said to show that stigmas of different varieties differ markedly in their ability to stimulate germination and growth of pollen tubes. See also a previous note (E. S. R., 49, p. 437).

**Hybridization of *Vitis rotundifolia*: Inheritance of anatomical stem characters.** C. F. WILLIAMS (*North Carolina Sta. Tech. Bul.* 23 (1923), pp. 3-16, pls. 17).—A microscopical study of the anatomy of mature 1-year canes of *V. rotundifolia*, *V. vinifera*, and F<sub>1</sub> hybrids thereof, whose external characters have already been described in detail in an earlier paper (E. S. R., 41, p. 729), showed marked difference in the internal structure, leading the author to conclude that hybrids inherit anatomical characters just as strikingly as they do morphological characters. The characters of the hybrids were intermediate, resembling either parent in varying degree, but with possibly greater resemblance to *V. rotundifolia*. Hybrids of *V. rotundifolia* × Winchell showed less resemblance to the *V. rotundifolia* parent than did hybrids between the *V. rotundifolia* and *V. vinifera*. The degree of the expression of the intermediate condition was about uniform in all the characters of any one vine. That is, a vine with more resemblance to one parent in any single character had more resemblance to that parent in its other characters.

## FIELD CROPS.

**Electroculture work in 1922 and 1923** (*Jour. Min. Agr. [Gt. Brit.]*, 30 (1923), No. 4, pp. 321-326).—Experiments in 1922 are reviewed and prospective work is outlined. See also a previous note (E. S. R., 49, p. 224).

Where barley in pots was subjected to discharges for six hours and one hour at different stages of growth, with one exception very marked increases in grain yield were obtained, reaching even 118 per cent. These large increases in grain yield were usually associated with very small increases in total yield. The effect was so marked that it seemed to establish a differential action of the discharge, that of accelerating reproductive growth apart from vegetative growth. Electrification for the first, second, and third month, respectively, of the growing season gave in all cases large increases of grain, the second monthly period giving the highest with a yield more than double that of nonelectrified plants.

A current only about 100 times the value of the normal atmospheric current continued for the full period seemed as effective as a stronger current, except in the case of plants electrified for the second month. The removal of plants from the influence of the normal atmospheric current was accompanied by a slight reduction in yield. Field measurements at Rothamsted indicated that with overhead wires whose distance apart is not much in excess of their height, fully half the current supplied to the wires may be expected to reach the crop. A very considerable area surrounding the electroculture area, especially on its leeward side, appears to receive a discharge much in excess of that which passes normally between air and earth.

**Electrocultural experiments at Bellevue in 1920-1921** (*Min. Instr. Pub. [France]*, *Bul. Off. Dir. Recherches Sci. et Indus. et Invent.*, No. 32 (1922), pp. 360-382, figs. 15).—Electrification of small plats of potatoes, sugar beets, and tobacco, and of a number of vegetables was generally followed by increases



in plant growth and crop yield. Maryland tobacco exhibited the greatest response to the discharges, giving decided average increases in number and weight of leaves, weight of stalk, and height. Advantage in favor of electrified plants could be noted throughout the growing season.

Crop tests at the Cooperative Testing Station, Sacaton, Ariz., C. J. KING (*U. S. Dept. Agr., Dept. Circ. 277 (1923), pp. 1-22, 23-25, 37-40, figs. 11*).—Experimental work reported on includes variety tests with cotton, barley, Indian and June corn, sorghum, sorgo, wheat, alfalfa, field peas, sweet potatoes, peanuts, and flax; cultural tests with rye and Rhodes grass; and seeding, spacing, rotation and irrigation (E. S. R., 47, p. 133; 49 p. 330) trials with cotton. Seed production with cotton, June corn, and alfalfa, and ratooning and fertilizer tests with cotton are described by A. R. Leding. Breeding work and genetic studies with Egyptian cotton, by T. H. Kearney, have been noted earlier (E. S. R., 45, p. 341; 48, p. 229; 49, p. 226). The history of the investigations, scope of the work, and climatic and soil conditions are touched upon briefly, including meteorological observations from 1910 to 1921 at Sacaton and comparative data regarding killing frosts at Phoenix for the same period.

Yield and frost data suggest the optimum time for planting cotton in the Salt River Valley to be within the first two weeks of March. In seasons with insufficient rainfall during the critical growing period, the highest yields of seed cotton were made in 30-in. rows with 4-in. spacing, while in years with heavy rains in July and August cotton in 30-in. rows with 12-in. spacing produced best. Cotton in alternative years with alfalfa and cotton continuously, manured, gave the highest yields of seed cotton in a comparison of 2-year rotations.

[Field crops investigations in Minnesota, 1921], A. BOSS ET AL. (*Minnesota Sta. Rpt. 1922, pp. 50-52, 54, 55, fig. 1*).—Experiments with field crops are reported on as heretofore (E. S. R., 47, p. 331).

Breeding work was carried on with wheat, oats, barley, corn, and red clover. Minhardi and Buffum 17 proved the hardiest of winter wheat varieties during the winter of 1921-22. Several selections from Marquis×Iumillo durum had the rust resistance of the durum and the appearance of a vulgare wheat. Oats breeding studies have produced 26 strains of crosses between White Russian and either Minota or Victory. These strains are open-panicle types, resistant to stem rust, and mature much earlier than White Russian. A selection of Sixty-Day oats excels in strength of straw and has given good yields. Studies with Rustler White Dent corn indicated that little difference exists between various methods of selection if seed is stored similarly and only those ears giving vigorous germination are used for planting. Cytological studies in wheat indicated that there is no correlation between morphological and botanical head characters and sterility.

Winter wheat and rye sown after September 30 yielded decidedly less than seedlings from September 1 to 30. Delays in seeding of from 10 to 20 days reduced yields of spring wheat, oats, and barley materially, and flour from wheat sown from 10 to 30 days later than usual was somewhat inferior for baking purposes. Respective acre rates of 64 lbs. of oats, 90 of wheat, 96 of barley, and 84 of rye per acre seem to be satisfactory. Mixtures of Iowar oats and Improved Manchuria barley, or Victory oats and Marquis wheat, or Marquis wheat and North Dakota Resistant flax, yielded more pounds per acre than either member of the crop pairs seeded alone. When pure strains of wheat, oats, and barley from University Farm were grown at different points in the United States, it was found that considerable carbohydrate material from the kernels is lost during the ripening process, while the



moisture content is still as high as 40 per cent. Such a loss influences the protein content of these grains.

From 60 to 90 lbs. per acre of soy beans, drilled in rows 6 in. apart without cultivation, at Coon Creek, yielded much less than 30 lbs. per acre in 36-in rows with the usual cultivation. Late plantings of soy beans yielded less than early May seedings.

Annual white sweet clover at University Farm yielded as much per acre as biennial yellow sown at the same time, and slightly more than biennial white. Roots of the annual white at a 1-ft. depth had a very much lower weight of dry matter and lower percentage of nitrogen than those of the biennial yellow and white. Mixtures of grasses and legumes on peat at Coon Creek gave two cuttings of hay and yielded higher than either crop sown alone, while grasses produced only one cutting.

[Field crops work at the Grand Rapids, Minn., Substation, 1921], O. I. BERGH (*Minnesota Sta. Rpt. 1922, pp. 136, 137, 138, 139*).—Continued tests (E. S. R., 47, p. 332) showed the following varieties to be foremost: Marquis spring wheat, Norway and Victory oats, South African×Manchuria barley, Irish Cobbler potatoes, Carter Hardy Swede rutabagas, Giant Feeding mangels, and Klein Wanzlebener sugar beets.

The highest yielding stocks in cooperative strain tests with potatoes are indicated, with sources and acre yields. Adjacent hills were seen to make up only a part of the loss by a missing hill. Where 2 hills were missing there was a total loss of 1 hill and between 70 and 80 per cent of the other. Little difference was observed between varieties in their ability to use to advantage the extra space resulting from a missing hill. A much larger decrease in the strength of the corrosive sublimate was noted after treating potatoes in gunny sacks than when treating them in wooden containers without sacks.

[Field crops work at Waseca, Minn., Substation, 1921], R. E. HODGSON (*Minnesota Sta. Rpt. 1922, pp. 148-150*).—The progress of earlier investigations (E. S. R., 47, p. 333) is reported. Varietal leaders included Marquis spring wheat, Minturki winter wheat, a selection of Sixty-Day oats, Improved Manchuria and Lion×Manchuria barley, Rosen rye, and Wisconsin Pedigree soy beans.

[Field crops work in Montana], C. MCKEE, H. E. MURDOCK, A. OSENBRUG, and G. MORGAN (*Montana Sta. Rpt. 1922, pp. 14, 15, 16, 31-33*).—Agronomic experiments are reported on, continuing earlier work (E. S. R., 49, p. 129). Varietal leaders included Kanred and Montana 36 winter wheat; Federation, White Federation, and Hard Federation spring wheat; Victory and Silvermine oats; Trebi and Beldi barley; Mandan King corn; and Early Mammoth sunflowers. Sunflowers planted May 6 heavily outyielded May 20 plantings. Both yield and quality of wheat were affected by the time and manner of irrigation.

Summer fallowing the land for winter wheat every second year seems to be giving increasingly greater crop yields over continuous cropping at the Judith Basin Substation and is recommended as the more profitable practice. For spring crops, however, the average yield increase would scarcely pay for the extra cultivation costs. Oats, spring wheat, and flax, seeded on corn land manured the spring before it was plowed for corn, yielded 8, 8, and 2 bu. per acre, respectively, more than on unmanured corn land. Manure applied to land just before corn was planted caused increased yields, but gave no benefits whatever when applied immediately before the small grains were seeded. Winter wheat furrow drilled has averaged 26 bu. per acre as compared with

19 bu. for the ordinary drill. The leaders in variety trials with winter and spring wheat, alfalfa, and root crops are pointed out. Experiments with annual forage crops on dry land and alfalfa and grasses have been noted (E. S. R., 49, p. 430).

Six years' results at the North Montana Substation show that small grains can be grown more economically on corn land than on summer fallow, provided the corn can be used to advantage. Where grain is the principal farm crop, part should be sown on corn land and the rest on fallow. Yields of grain on fallow have been higher than with other methods and were surer in extremely dry years. Grimm and Baltic and northern-grown strains of common alfalfa showed the best winter resistance and gave heavy yields of hay. Alfalfa in 48-in. cultivated rows yielded highest in dry years, while in years of more favorable rainfall closer rows gave the best results. Grass yields were better in 3-ft. cultivated rows than in 6-in. drills. Root crops after fallow made about 6 tons per acre and only 3 tons after grain.

[Report of field crops work in Northumberland County, England], D. A. GILCHRIST (*County Northumb. Ed Com. Bul. 35* (1923), pp. 9-58).—The progress of experiments with field crops is reported in continuation of work noted earlier (E. S. R., 48, p. 228).

[Report of field crops work in British Guiana], J. B. HARRISON and W. FRANCIS (*Brit. Guiana Dept. Sci. and Agr. Rpt. 1920*, pp. 4-13; 1921, pp. 4-10).—The continuation of experiments with sugar cane and rice (E. S. R., 46, p. 727) is reported. In 1921, 32.5 per cent of the total cultivated area of the colony was devoted to rice and 36.8 per cent to sugar cane. The leading varieties of sugar cane in the 1922 crop with their respective percentages of the total area in sugar cane were D. 625 62.2 per cent, D. 145 7.6, D. 118 4.3, B. 208 3.2, and Bourbon 2.7 per cent.

Report on grain varieties, M. E. MCCOLLAM (*Western Washington Sta. Bimo. Bul.*, 11 (1923), No. 4, pp. 67-69).—Among the leading varieties of cereals in tests from 1916 to 1923, inclusive, were Brown Squarehead winter wheat, Gray Winter oats, White Winter barley, Rosen rye, Pacific (Palouse) Blue-stem spring wheat, Abundance, Mainstaff, and Sparrowbill spring oats, and Hannchen barley.

The relation of seed weight to the growth of buckwheat in culture solution, D. SCHMIDT (*Soil Sci.*, 15 (1923), No. 4, pp. 285-292, figs. 2).—Buckwheat from seed of five different weight grades was grown in solution cultures under nearly similar conditions at the New Jersey Experiment Stations.

Seed of high medium weight produced better plants than lighter or abnormally heavy seed, and, excepting the latter, the order of superiority of the plants corresponded to the order of seed weight. The superiority of plants from heavier seeds over those from lighter seeds was maintained from the early seedling phase to maturity. Leaf areas were about proportional to dry weights of tops and to total dry weights, but such relation was not apparent between dry weights of roots and leaf areas.

A study of flax and kindred fibers, II, C. R. NODDER (*Jour. Textile Inst.*, 13 (1922), No. 10, pp. 213-219, figs. 16).—Further observations (E. S. R., 49, p. 33) on flax and cotton fibers are recorded in this contribution from the Linen Industry Research Association.

Flax and cotton fibers greatly resemble each other in structure although they are not homologous, indicating that the properties of the cellulose largely determine the architecture of the fibers. Very similar "discoloration marks" occur in flax and cotton, and both fibers have minute pores in the cell wall.



[Report of the Linen Industry Research Association, 1922] (*Linen Indus. Research Assoc. [Lambeg, Co. Antrim], Rpt. Council, 1922, pp. 24, pls. 4*).—Activities with flax at the research institute at Lambeg (near Belfast), reported on briefly, include agronomic and botanical studies, and retting, spinning, weaving, bleaching, dyeing, sizing, and finishing experiments.

Early detachment of the seed capsules from the plant neither depreciated the value of the fiber from the straw nor the value of the seed for sowing or for oil. At the customary time of harvesting flax for fiber purposes, the maximum weight of oil has, within practical limits, been deposited in the seed.

**Irrigation experiments with potatoes**, F. S. HARRIS and D. W. PITTMAN (*Utah Sta. Bul. 187 (1923), pp. 15, figs. 7*).—The continuation of irrigation studies with potatoes from 1917 to 1921, inclusive, gave results said to substantiate those reported earlier (*E. S. R., 37, p. 740*).

Where the water was limited, larger yields were obtained by applying it in several small, rather than fewer heavier, irrigations. The highest yields were obtained with moderate irrigation at regular intervals (7 and 14 days) during the dry summer season, beginning when the plants were 6 in. high and stopping about a month before harvest. As a rule more than 25 acre-in. of irrigation water caused a decrease in yield, but during exceptional years more water was needed for the largest yield. Less than 10 acre-in. of irrigation water generally gave a low yield.

The largest tubers and the largest hills of potatoes were produced with from 20 to 25 acre-in. of irrigation water, either more or less decreasing the size of tuber and average weight of hills, respectively. Excessive irrigation gave rise to many small-sized potatoes.

**Potatoes**, F. M. HARRINGTON and H. THORNBUR (*Montana Sta. Rpt. 1922, pp. 23, 24, 29, 30*).—Nearly every one of 324 lines of potatoes carried in studies since 1916 has shown a steady decline in yielding power, and the work as a whole showed that in an average potato field about 25 per cent of definitely poor units may be expected, 25 per cent of units above the average, and 50 per cent only fair. Since a close correlation is indicated between top characters and productivity, selection based on top characters is deemed not only safer but easier than bin selection. Distance of planting and frequency of irrigation controlled the size of tubers to a marked extent. A 7-in. spacing in the row gave best results at the station and 10 in. at Victor.

**Composition of potato tubers**, J. J. WILLAMAN and R. M. WEST (*Minnesota Sta. Rpt. 1922, p. 44*).—Analyses of several varieties of potatoes grown under different conditions in several parts of Minnesota, and a statistical study to determine what factors affect the composition of the tubers, are reported briefly.

The early varieties were characterized by lower dry matter content and higher protein. The protein was usually higher in the samples from the southern part of the State than in those grown in the northern part. The ratios among the various constituents remained about the same throughout the growth of the tubers. The percentage of dry matter increased steadily up to maturity. A strong correlation was observed between specific gravity and percentage of dry matter. However, on the dry matter basis, no correlation existed between the specific gravity and either the starch or the protein content. The breeding of a variety of potato with a higher proportion of protein to carbohydrate, which would still retain desirable culinary properties, is thought possible. Such tubers would have a higher percentage of dry matter and would be spheroidal rather than long or flat in shape.



[Variety tests with rye] I. WÄLSTEDT (*Sveriges Utsädesför. Tidskr.*, 33 (1923), No. 2, pp. 109–117).—The results of testing varieties of rye, largely new varieties originated at Svalöf and tested from 1915–1922 at the Swedish Seed Association Experiment Station at Tornby and from 1911–1922 in local cooperative experiments, are reported. Among 12 varieties tested at the experiment station, 0301 Stjärn and 0302 Stål rye ranked highest in average yield, with 56.27 and 57.1 bu. per acre, respectively. These varieties also stood high in strength of straw, and the average weight per bushel was 56.85 lbs. for 0301 Stjärn and 57.24 lbs. for 0302 Stål. The growing periods of the two varieties are practically identical, being about 331 days, the variation for the 12 varieties on test being 325.2 to 331.1 days.

In the local cooperative tests, made with only four varieties these same sorts maintained their lead in yielding capacity, Stjärn rye giving in one series of trials 11.3 per cent and Stål rye 12.7 per cent more grain than was secured from Petkus, the standard variety, with which they were compared. In these experiments a variety designated as Svalöf 0451 also gave good returns, out-yielding Petkus by 10.9 per cent in grain and 14.2 per cent in straw.

**Irrigation experiments with sugar beets**, F. S. HARRIS and D. W. PITTMAN (*Utah Sta. Bul.* 186 (1923), pp. 19, figs. 11).—Irrigation experiments with sugar beets were carried on from 1917 to 1921, inclusive, in continuation of earlier work (*E. S. R.*, 37, p. 741).

Where the quantity of water was limited, larger yields were obtained by applying it in several small, rather than fewer larger, irrigations. Weekly or alternate weekly small (2- or 3-in.) irrigations gave the largest yields of beets. More than 20 in. of irrigation water appeared to cause a slight decrease in yield, but in dry years the optimum was higher. Frequent crop failures were observed when less than 10 in. of irrigation water was applied. Within the variations of irrigation treatment noted, the height and yield of tops was a fairly good index to the yield of beets.

As long as irrigation was restricted to the period from two weeks after thinning until about a month before harvest, its distribution had little effect on the sugar content or purity of the beets or on the proportion of forked beets. A rainy fall preceded by a dry summer was accompanied by a marked lowering of the sugar content and purity, whereas a noticeable increase was found with reversed weather conditions. The irrigation treatments giving the largest yield of beets also produced the largest individual beets by weight, but the treatment did not appreciably affect the length of the beets.

**The culture and diseases of the sweet potato**, J. J. TAUBENHAUS (*New York: E. P. Dutton & Co.*, 1923, pp. XV+286, pls. 29).—Information concerning the sweet potato industry is presented in three sections in this volume. Part 1 embraces production statistics and practices, propagation, cultural and field practices, varieties, harvesting methods, and uses of the crop; part 2 treats of the morphology of the healthy plant, disease losses, specific diseases, and insects and other pests; and part 3 deals with storage methods, physiological changes during storage, curing, construction of curing and storage houses, and marketing practices. A bibliography is appended.

**The sweet potato in Hawaii**, H. L. CHUNG (*Hawaii Sta. Bul.* 50 (1923), pp. 20, pls. 4).—Cultural methods and field practices approved for growing sweet potatoes in Hawaii are detailed, together with information on the history of the crop in Hawaii, its environmental needs and place in the cropping system, grading and storage, cost of production, diseases and insect pests and their control, varieties, composition of the sweet potato, cassava, taro, and potato, and methods of preparing the sweet potato for the table and as feed for farm



animals. The chemical composition of sweet potato vines is compared with that of pigweed and honohono (*Commelina nudiflora*). Experimental work with sweet potatoes at the station has also been noted from another source (E. S. R., 48, p. 330).

Rows of sweet potatoes with vines cut to lengths of 12 and 18 in. produced yields of roots approximating 31 and 49 per cent, respectively, of that obtained from unpruned vines. Sweet potatoes sacked and stored in a cool, dry room lost 12 per cent of the original weight in 21 days, about 6 per cent in the first week and 6 per cent during the next two weeks. It cost about one-half more to produce the crop in Hawaii than on the mainland.

[**Tobacco production in the Connecticut Valley**] (*Tobacco*, 76 (1923), No. 9, pp. 15-23, 25, 27, 29, 31, 33, 35, 37, 41, figs. 47).—Among the papers included in this number are the following: Tobacco in Connecticut Valley from Colonial Days to Present Time, and The Connecticut Valley's Tobacco Industry from Seed Bed to Market, both by A. S. Brown; New England Tobacco Production and the New Marketing Method, by W. K. Ackley; The Valuable Work of the Connecticut Tobacco Experiment Station, by G. H. Chapman; Tobacco at the Massachusetts Agricultural Experiment Station, by S. B. Haskell; Importance of Tobacco Culture in Connecticut and Massachusetts, by D. D. Long; and Importance of Fertilizers in Growing Connecticut Shade Tobacco, by E. P. Brewer.

**The biochemistry of cold resistance in winter wheat**, R. NEWTON and R. A. GORTNER (*Minnesota Sta. Rpt. 1922*, p. 45).—Cold resistance in winter wheat (E. S. R., 47, p. 38) is said to be accompanied by a marked increase in the hydrophilic colloids in the expressed sap. It is believed that as the plant responds to the cold stimuli these colloids are elaborated in the cells. The colloids bind the water and protect the protoplasm from death by freezing. Winter hardiness is considered to be directly proportional to the quantity of such colloids which the plant elaborates. The ease with which water can be expressed from the leaf tissues is said to afford a good criterion of hydrophilic colloid content and of winter hardiness.

[**Seed and weed studies at the Minnesota Station**], A. H. LARSON, H. C. GILBERT, and R. URE (*Minnesota Sta. Rpt. 1922*, pp. 100, 101).—The activities of the seed laboratories are described briefly.

Lettuce germinated best when the seeds had been soaked for six hours and then exposed to indirect sunlight, with a constant temperature of about 23° C. (73.4° F.). Specimens received indicate that sow thistle is now in almost every county in Minnesota, even in some farthest removed from the primary infestations in the northwestern part of the State.

## HORTICULTURE.

[**Horticultural investigations at the Cooperative Testing Station, Sacaton, Ariz.**], C. J. KING (*U. S. Dept. Agr., Dept. Circ. 277* (1923), pp. 22, 23, 26-35, figs. 16).—Information is presented concerning the results of tests with various fruit, vegetable, and ornamental plants.

As the result of selection work, continued since 1907, with the White Bermuda onion there has been developed an improved strain which, because of its superior qualities, has been designated as the Sacaton Bermuda. Other onion varieties that have given satisfactory results are the Red Dongolia, Crystal Wax, Prizetaker, and Australian Brown. Onion seed produced at the station has proved equally as reliable as imported stock.

Of various watermelons tested, the Kleckley Sweet, Klondike, Black-Seeded Chilean, White-Seeded Chilean, Tom Watson, and Alabama Sweet have proved



adapted to general planting. Of muskmelons, the Rocky Ford proved to be the best type, but other varieties, including the Eden Gem and Extra Early Hackensack, are well adapted.

The more common fruits, peach, apricot, apple, pear, quince, and plum, have not proved satisfactory, some of the trees bearing heavily for a short time and then succumbing to adverse conditions. Jujubes produced heavily and endured the environment. *Prunus (Amygdalus) davidiana*, although thriving for a time, soon failed. The date plantations, consisting of 416 trees, comprising 27 varieties and 316 seedlings, have been fairly successful. However, the Deglet Noor and Rhars are unable to endure the climate, and seldom mature a full crop. Some of the seedlings, on the other hand, show promise. Grapes of the vinifera species have been extensively tested, and the Sultana, Sultanina, and Malaga from Fresno have proved especially well suited as fresh grapes for Arizona conditions. Among pecans, the Alley, Delmas, Stuart, and Georgia have given good results. The pomegranate has proved satisfactory, and of over 30 named varieties many have borne abundant crops. The Wonderful, Hermosillo, Greenrind, Jative, Spanish Ruby, and Sweet Fruited are recommended for general planting.

Among ornamental plants, the climbing Kaiserin Augusta Victoria and Mademoiselle Cecile Brunner roses have given satisfactory results. Various evergreen and deciduous trees are listed which have shown value for shade and ornamental purposes. The pistache tree is of value not only as a furnisher of shade, but also as a nut producer. The native ironwood (*Olneya tesota*) is also regarded with favor.

[Horticultural investigations at the Minnesota Station], W. H. ALDERMAN ET AL. (*Minnesota Sta. Rpt. 1922, pp. 85-88, 89-92, 94, figs. 2*).—Continuing the work of previous years (E. S. R., 47, p. 338), a few wild blueberry plants possessing superior qualities were selected by Alderman and W. G. Brierley at Cloquet and Grand Rapids for further study. The use of peat on blueberry plants, either as a mulch after planting or for disking in previous to planting, resulted in higher percentages of living plants. It was noted that large vigorous plants of both *Vaccinium pennsylvanicum* and *V. canadense* were more successful in rooting than were smaller plants.

Based on results of extended tests conducted throughout the State, it is reported that the Premier, Gibson, and Minnehaha strawberries are valuable commercial varieties. Top-working studies at Delano and Newport indicate that Hibernial is a more satisfactory stock than the Virginia crab, having a better distribution of scaffold limbs and being easier to graft. Top-worked Wealthy trees were slower in coming into bearing than similar nursery grown material. However, early bearing was offset by the stronger scaffold of the top-worked trees. Gauged by measurements of shoot growth and observations on wound healing and tip killing, no marked differences were found between fall and spring pruned apple trees, leading to the conclusion that orchards may be pruned at either season.

Brierley reports that the Thomas black walnut may come into bearing in its fourth year. Filberts, sweet chestnuts, and heart nuts showed considerable winter injury.

Variety tests were carried on by W. T. Tapley with all important species of garden vegetables. A comparison, by J. W. Bushnell, of nine inbred strains of Hubbard squash with their first generation hybrids leads to the general conclusion that F<sub>1</sub> hybrids are not appreciably more vigorous than the inbred parental lines. The Kitchenette Hubbard was distributed to eight Minnesota seedsmen. Selected strains of the Alaska pea developed from individual plants



gave appreciably larger yields than the average selections from commercial lots. A comparison of strain selections of Keeney Stringless Refugee beans with plants raised from seed received directly from the originator showed no appreciable differences in yield, leading to the conclusion that single plant selections are of little value in this bean, the material probably being a pure line. Individual plant records taken by Tapley on 32 strains, representing 19 varieties of tomatoes, showed marked variations in productivity, the maximum yield per plant being produced by a Burbank strain selected in 1920 for high yield. Overhead irrigation studies conducted during the summer of 1921 showed marked increase in the yield of tomatoes, carrots, onions, and cabbage from irrigation.

[**Horticultural investigations at the Montana Station**], F. M. HARRINGTON and H. THORNER (*Montana Sta. Rpt. 1922, pp. 24, 25, 28, 29*).—As in the previous year (*E. S. R.*, 49, p. 136), this report consists largely of notes upon the behavior of varieties of vegetables and fruits. Tomato plants grown from home selected seed not only outyielded those raised from commercial seed, but in addition were earlier in ripening their fruits. Of five asparagus varieties, Giant Argenteuil, Conover Colossal, Columbia Mammoth White, Barr Mammoth, and Palmetto, no one variety has proved particularly better than the others, all giving satisfactory results. Nuetta, Golden Bantam, and Early June were superior sweet corn varieties, especially for the higher altitudes. Red raspberries, given good pruning, winter protection, and cultivation, succeed even in the higher altitudes. The Latham, Sunbeam, Ohta, and Herbert are considered outstanding varieties. The Hanska plum was more satisfactory than any other variety tested at Bozeman.

Orchard management studies at Victor are again reviewed (*E. S. R.*, 49, p. 833). The DeSoto, Hanska, Lombard, and Reine Claude plums showed particular merit at the substation in 1922. The Pond Seedling prune, however, suffered severe winter injury. An ear to row test with Golden Bantam and Peep o'Day sweet corn indicated possibilities in selecting for time of maturity, size of plant, and yield. The Great Northern, California White, and Davis White Wax beans are considered satisfactory.

**The vegetable garden**, I. D. BENNETT, rev. by A. KRUEH (*New York: Doubleday, Page & Co., 1923, [2. ed.], rev. and enl., pp. XII+231, pls. 26*).—A revision of an earlier noted text (*E. S. R.*, 21, p. 440).

**The chayote: Its culture and uses**, L. G. HOOVER (*U. S. Dept. Agr., Dept. Circ. 286 (1923), pp. 11, pls. 4, figs. 4*).—Information of a popular nature is presented relative to the native home of the chayote, its adaptability for cultivation in the southern United States, varieties, cultural directions, uses, recipes for cooking, and market possibilities.

**Growing spinach in Arizona**, D. W. ALBERT (*Arizona Sta. Timely Hints for Farmers, No. 144 (1923), pp. 9, figs. 3*).—Although consisting for the most part of general information relating to varieties, cultural requirements, diseases, and insect pests, data are presented upon the results of tests of methods and time of planting conducted at the Yuma Substation during 1920 and 1921. Based upon the results secured with four standard varieties of spinach, furrow planting increased yields by approximately 20 per cent. Spinach planted on October 15 outyielded later plantings extending to December 24.

**Cool storage of tomatoes: Experiments in keeping qualities**, D. B. ADAM (*Jour. Dept. Agr. Victoria, 21 (1923), No. 10, pp. 621, 622*).—Tomatoes picked when comparatively green and stored in bran at 32° F. remained firm and sound, but failed to develop either color or flavor. The tests with tomatoes



picked when half, three-quarters, and fully ripe and stored in flat crates at 31, 33, and 35° indicated that fruits should be picked when three-quarters ripe and stored at 33–34° in ventilated chambers where the humidity is relatively low. The storage life of tomatoes was found to be limited by the development of molds. The average storage expectancy of from 7 to 10 days may be lengthened to 3 weeks if the fruits are handled with extra care.

**Productive orcharding: Modern methods of growing and marketing fruit**, F. C. SEARS (*Philadelphia and London: J. B. Lippincott Co., 1923, 3. ed., rev., pp. [12]+315, pls. 3, figs. 153*).—This is a revised edition of a previously noted text (E. S. R., 32, p. 394).

[Report of the Minnesota Station] **fruit breeding farm**, C. HARALSON (*Minnesota Sta. Rpt. 1922, pp. 95, 96*).—Two new fruits, the Haralson apple and the Goldenrod plum, both developed at the farm, were named and distributed during the year.

**Influence of stock on scion**, G. RIVIÈRE and G. PICHARD (*Jour. Soc. Natl. Hort. France, 4. ser., 24 (1923), Oct., pp. 431–433*).—The average weight of 10 Calville Blanc apples grown on a tree top-worked on Apl Rose, itself grown on Paradise stock, was 250 gm., as compared with 176 gm. for the same variety of apples grown on a tree grafted directly on Paradise roots.

**The transmission of nematode resistance in the peach**, J. A. MCCLINTOCK (*Science, 58 (1923), No. 1510, pp. 466, 467*).—That peach trees differ in their ability to resist root-attacking nematodes was shown in studies carried on at the Georgia Experiment Station, where it was found that a lot of trees raised from seed obtained in Florida was practically free from root knots, while contiguous trees grown from Georgia seed were heavily infested. Furthermore, seedlings produced from fruit borne by the resistant trees manifested like resistance, indicating that the factor is transmitted through the seed, thus giving the results much greater significance since peach stocks in ordinary nursery practice are increased by seedage.

**Production of improved hardy strawberries for Alaska**, C. C. GEORGESON (*Alaska Stas. Bul. 4 (1923), pp. 13, pls. 10*).—In bringing together information much of which has been previously noted in earlier reports (E. S. R., 49, p. 434), the author reviews the history of strawberry development in Alaska, discusses the hybridization of native with introduced species, and describes the various species and some of their hybrids. A tabulated list is presented showing the parentage of all strawberry seedlings developed at the Sitka Station, and information of a general nature is included relative to proper cultural practices for the interior and coast environments.

**Our medicinal plants**, H. MARZELL (*Unsere Heilpflanzen ihre Geschichte und ihre Stellung in der Volkskunde. Freiburg im Breisgau, Germany: Theodor Fisher, 1922, pp. XXVIII+240, figs. 38*).—A pamphlet relating to the history and the references in folklore to various German plants which are used for medical purposes.

**The ethereal oil producing plants of the Dutch East Indies**, A. W. K. DE JONG (*Ber. Afd. Handelsmus. Kolon. Inst. [Amsterdam], No. 7 [1922], pp. VII+183, figs. 49*).—Information is presented concerning the botany, culture, and preparation of products of various plants, including thyme, mint, lavender, fennel, camphor, balsam, etc.

**Chrysanthemums for the home**, B. Y. MORRISON (*U. S. Dept. Agr., Farmers' Bul. 1311 (1923), pp. II+17, figs. 14*).—Devoting his attention to the hardy varieties of chrysanthemums adapted to outdoor growing with little or no protection, the author presents in a popular manner information relative to varieties,



propagation, soil preparation, fertilizing, staking, pruning, disbudding, shelters, types of blooms, and the combating of insect enemies.

**Delphiniums and how to excel with them**, A. J. MACSELF (*London: George Newnes, Ltd., New York: Charles Scribner's Sons, 1923, pp. 31*).—A practical booklet devoted to propagation, cultivation, and exhibition.

**House plants and their care**, W. B. BALCH (*Kansas Sta. Circ. 100 (1923), pp. 16, figs. 6*).—General information is presented relative to moisture, temperature, light, and soil requirements of house plants, and directions are given for their propagation, potting, and protection from insect and fungus enemies. It is emphasized that many house plants require a rest period, during which no fertilizers and only a very moderate supply of water should be given. Condensed hints for the care of house plants are included and suggestions given for varieties and species adapted to indoor and outdoor window box culture.

## FORESTRY.

**Forest resources of the world**, R. ZON and W. N. SPARHAWK (*New York and London: McGraw-Hill Book Co., Inc., 1923, vols. 1, pp. XIV+493, pls. 9, figs. 13; 2, pp. VII+495-997, pls. 7, fig. 1*).—This work, prepared under the authority of the Secretary of Agriculture of the United States and in co-operation with the National Research Council, constitutes a comprehensive inventory of the timber supplies of the entire world. As pointed out by the authors, the information is limited by the difficulties in obtaining accurate information regarding the more remote and unexplored regions. In connection with the forest maps of the various areas, information is presented relative to the extent and character of the forests, approximate stand, present rate of utilization, rate of growth, and managerial policies now existing.

**Forest products research in the United States**, W. B. GREELEY (*Lumber World Rev., 45 (1923), No. 9, pp. 54-56*).—A paper presented before the second British Empire Forestry Conference, at Ottawa, Ont., in August, 1923, in which the author reviews the work of the U. S. Forest Products Laboratory, at Madison, Wis., in developing improved methods for wood utilization and treatment in a general endeavor to reduce the enormous waste, estimated at more than 9 billion out of an annual cut of 22½ billion cu. ft.

**Forest investigative work of the Dominion Forest Service**, W. G. WRIGHT (*Canada Dept. Int., Forestry Branch Circ. 17 (1923), pp. 5*).—This circular constitutes a brief sketch of the work being conducted by the Dominion Forest Service, the work inaugurated by the commissioner of conservation and now being carried on by the Forest Service being included.

**Progress report of forest administration in Coorg for the year 1921-22**, A. F. MINCHIN (*Coorg Forest Admin. Rpt., 1921-22, pp. [35]*).—The usual annual report (E. S. R., 47, p. 837) relating to alterations in area, revenues, expenditures, etc.

**Instructions for appraising stumpage on national forests** (*U. S. Dept. Agr., Forest Serv., 1922, pp. VI+73*).—A revision of an earlier noted publication (E. S. R., 32, p. 340).

**A forest fire prevention handbook for the school children of California** (*U. S. Dept. Agr., Misc. Circ. 7 (1923), pp. [2]+24, figs. 26*).—This pamphlet, prepared cooperatively by the Forest Service, the California State forester, and the superintendent of public instruction of the State of California, is comprised of five lessons, as follows: (1) The forests of California, containing information relative to the location, extent, kind of species, and amount of timber, (2) the effect of fires, (3) the causes of fires, (4) fire prevention, and (5) how fires are detected and fought.

**Frost heaving of western yellow pine seedlings**, F. W. HAASIS (*Ecology*, 4 (1923), No. 4, pp. 378-390, figs. 5).—Examination during the winter of 1919-20 of a large number of western yellow pine seedlings showed a maximum heaving mortality of 16.5 per cent in those plants which were enduring their first winter. Older seedlings, namely those ranging between 2 and 6 years of age, suffered 8.3 per cent loss. A study of the factors involved in the heaving injury indicated that temperature, moisture, ground cover, shade, and the anatomy of the plant are all important considerations. Injury was found to be greatest in those soils containing a maximum amount of water. Snow, brush, and ground cover, and probably litter and pebbles served to reduce, while shading is believed to increase, heaving. In an attempt to measure the number of pounds of pull required to extract seedlings from the ground in April, it was found that plants would break off before releasing their roots. In one instance a plant withstood a strain of 64 oz. before breaking.

**The suitability of western species for crossties**, O. M. BUTLER (*Jour. Forestry*, 21 (1923), No. 5, pp. 475-482).—The reduction in the local supply of timber suitable for the manufacture of railroad ties has led the eastern railroads of the United States to become interested in western species, a study of the suitability of which for tie purposes is reported in this paper. Tabulated results of strength tests show the western larch, Douglas fir, Port Orford cedar, and redwood to have the greatest strength values of any of the western species tested. On the basis of service tests for durability, redwood, Port Orford, and incense cedars were found best among 15 species. In respect to permeability of certain western species to preservative materials, practically all, with the exception of western yellow pine, fall in the category of timbers relatively difficult to treat. As a group, lodgepole pine, red and white fir, and Englemann spruce were somewhat more difficult to treat than was western yellow pine. Douglas fir, western hemlock, western larch, Sitka spruce, and Alpine fir possessed still greater resistance.

**Suitability of various American woods for pulp and paper making**, R. H. GRABOW (*Jour. Forestry*, 21 (1923), No. 5, pp. 462-474).—Pointing out that various kinds of paper are quite different in character and require different constituent materials, the author discusses various species and groups of species of conifer and broadleaf trees in respect to their pulping values. It is concluded that coniferous woods of low resin content are best adapted for sulphite pulping. The aspen and similar deciduous woods are deemed important for soda pulping. For mechanical pulp spruce, balsam, and hemlock are valuable in the order given. Waste material from certain infrequently used species such as basswood, ash, and cucumber wood, if available in sufficient quantities to supply pulp mills, offers possibilities.

## DISEASES OF PLANTS.

**Bibliography of the literature of plant protection, 1920**, H. MORSTATT (*Biol. Reichsanst. Land u. Forstw., Bibliog. Pflanzenschutzlit., 1920*, pp. 71).—A strictly systematic arrangement is presented, with author index, covering the output during the year 1920 of the literature relating to the more general aspects of plant pathology, to diseases or injuries and their causation, to plants affected, and to protective measures.

**Mycological and phytopathological notes**, R. CUFERRI (*Ann. Mycol.*, 20 (1922), No. 1-2, pp. 34-53, pl. 1, fig. 1).—An account is given of observation, research, and literature regarding a number of fungi, some new or newly described forms being indicated.



**Development of disease-resistant varieties of farm crops**, H. K. HAYES, E. C. STAKMAN, ET AL. (*Minnesota Sta. Rpt. 1922, p. 53*).—Cooperative experiments with the section of plant pathology are briefly reported upon. Between 5,000 and 6,000  $F_3$  lines of wheat were tested for their reaction to various biologic forms of stem rust, and approximately 2,000 of them showed some degree of resistance. These are being grown for further observation.

The mode of inheritance of resistance and susceptibility of black stem rust of oats was studied, and numerous resistant families with good agronomic characters have been secured.

Studies of corn smut in self-fertilized lines of corn are said to show marked differences. Those that were resistant one year proved resistant the following year.

Five strains of rust-resistant timothy and two wilt-resistant varieties of flax have been isolated for field tests.

**Garden truck diseases**, J. G. LEACH and E. C. STAKMAN (*Minnesota Sta. Rpt. 1922, pp. 99, 100*).—Greenhouse studies of bean anthracnose are said to indicate the existence of at least four distinct biologic forms of the organism.

Investigations of potato diseases are briefly reported upon from which it is claimed that a 5- or even a 3-year rotation with grain and clover reduces the amount of black scurf. In comparative tests of copper sulphate and formaldehyde for the treatment of seed tubers, the hot formaldehyde method gave the best control. A large amount of injury to potatoes due to leafhoppers was observed, and it is claimed that the hoppers were found to cause, in addition to the recognized hopper-burn, a pronounced dwarfing and stunting of the plants which seems to be transmitted through the tubers.

**Department of botany and bacteriology**, D. B. SWINGLE (*Montana Sta. Rpt. 1922, pp. 18, 19, 20*).—Summary accounts are given of the investigations carried on at the station during the period covered by the report, the principal investigations being on *Fusarium* diseases of potato, arsenical spray injury, and sunflower wilt. Detailed accounts have already been given by Morris and Nutting of the investigation on potato diseases (*E. S. R.*, 49, p. 646) and on arsenical spray injury (*E. S. R.*, 49, p. 750).

In the investigation of sunflower wilt studies were made on the effect of difference in distance of planting on the prevalence of the disease. When sunflowers were planted 8 to 12 in. apart in the row, 14.5 per cent were diseased, while when planted 4 in. or less apart, 29 per cent of the plants were infected.

[**Plant diseases, Brazil**], R. AVERNA-SACCÁ (*Bol. Agr. [Sao Paulo], 23. ser., No. 3-4 (1922), pp. 72-87, figs. 6*).—Notes are given, based on observations or reports, of plant diseases due to *Puccinia allii*, *Colletotrichum* (*Vermicularia*) *circinans*, *Megalonectria caespitosa*, *Macrophoma* sp., and *Botryosphaeria dothidea*.

**The biology of mildew**, J. KLIKA (*Ann. Mycol.*, 20 (1922), No. 1-2, pp. 74-80).—Infection and developmental experiments with *Oidium* from various sources on different hosts are given, with details partly in tabular form.

**Root knot: Its cause and control**, G. H. GODFREY (*U. S. Dept. Agr., Farmers' Bul. 1345 (1923), pp. II+27, figs. 26*).—This is a revised edition of Farmers' Bulletin 648, which has been previously noted (*E. S. R.*, 32, p. 842).

**Studies on ergot**, G. TANRET (*Bul. Sci. Pharmacol.*, 29 (1923), No. 4, pp. 169-175).—It appears from these studies that ergot (*Claviceps purpurea*) on the wild grass *Arundo festuoides* (*Ampelodesmos tenax*) and that on oat contain the same principles as does rye ergot, but in different proportions, ergotinin in crystalline form being much less abundant in ergot on *Arundo* and more abundant in that on *Avena* than in that on rye as it is ordinarily ergotized. The facts observed are briefly discussed from the standpoint of drug production.

**Cereal and forage crop diseases**, E. C. STAKMAN ET AL. (*Minnesota Sta. Rpt.* 1922, pp. 98, 99).—Progress is reported on breeding corn varieties resistant to smut. Continued studies on the varietal resistance to flax wilt have again demonstrated the superiority of Minnesota 182 and Minnesota 281. Three years' growth of resistant varieties on clean soil is said to indicate that the wilt-resistant qualities were not lost in the absence of the wilt organism. Preliminary results are said to indicate that with individual plant selections subsequent selection does not increase resistance to flax wilt.

Studies are reported on the root rot and foot rot of cereals caused by *Helminthosporium sativum*, in which 134 species of cereals and grasses were artificially inoculated. Wheat, barley, and rye were found to be very susceptible, while oats and corn were highly resistant or immune to the fungus. It is believed that there are four distinct biologic forms of the fungus.

Favorable results are reported on the use of copper carbonate dust as a treatment for the prevention of the covered smuts of cereals. A study of sunflower rust has shown that at least three biologic forms of rust are known.

**Rust of cereals**, E. C. STAKMAN ET AL. (*Minnesota Sta. Rpt.* 1922, p. 97, 98).—A brief report is given of cooperative experiments with the division of agronomy in which over 200 varieties of wheat were tested and about 4,000 hybrids produced for further study. Biochemical studies of wheat stem rust have been made to correlate individual physiological characters of biologic forms with their behavior on wheat varieties.

Further study of the effect of environment on the reaction of wheat to stem rust is said to have shown that the structure and character of leaf tissues are changed by certain nutrient salts, and that there is evidence to show that this may possibly alter the degree of infection obtained with certain biologic forms of rust.

In work on the genetics of rust resistance, immunity was found dominant, and it is believed that a single factor determines the reaction to several forms of the rust.

No biologic specialization has been observed in timothy rust. Four additional minor biologic forms of wheat stem rust and two of oat stem rust have been recognized.

**Black point of wheat**, N. S. EVANS (*Phytopathology*, 11 (1921), No. 12, p. 515).—An examination of a large number of discolored kernels of durum wheat showed the presence of a species of *Helminthosporium* similar to *H. sativum* on 77.6 per cent of the specimens. Inoculation experiments with water suspensions of conidia resulted in the formation of abundant black pointed grains.

**The effects of treatment for bunt on the germination of wheat**, G. L. ZUNDEL (*Phytopathology*, 11 (1921), No. 12, pp. 469-481, figs. 2).—The author claims that due to the dry atmosphere at the time of harvest in the State of Washington the wheat kernels are generally dry and brittle, and that during the process of threshing the seed coats are badly cracked. Subsequent treatment of wheat with fungicides often causes a high percentage of injury to germination. This injury, it is said, can be overcome by presoaking in water before using a fungicide, and following this by dipping the seed in lime. The most practical method for use under the conditions described is the dipping of wheat in limewater after treating it with copper sulphate solution or formaldehyde.

**Incidence of loose smut in wheat varieties**, F. D. FROMME (*Phytopathology*, 11 (1921), No. 12, pp. 507-510).—The author reports observations on the occurrence of loose smut (*Ustilago tritici*) on different varieties of wheat. From the data secured it is said that the three bearded varieties, Stoner, Red



Wonder, and Fulcaster, show quite uniform infection and greatly in excess of that shown by the three beardless varieties, Harvest King, Fultz, and Leap, which are almost entirely smut free.

**Pathogenicity of *Ophiobolus cariceti* in its relationship to weakened plants,** H. R. ROSEN and J. A. ELLIOTT (*Jour. Agr. Research* [U. S.], 25 (1923), No. 8, pp. 351-358, pls. 5).—The authors report the occurrence of *O. cariceti* in two wheat fields in Arkansas and on the campus of the State university. In addition to wheat, *Bromus secalinus*, *Chaetochloa geniculata*, *Festuca octoflora*, *F. elatior*, and *Hordeum pusillum* were found to be infected. Infection is believed to be confined to weakened plants, and a lack of proper nutrients and water-logged soils in particular were found to be conducive to attacks by the fungus.

In an experiment involving the use of lime, manure, and commercial fertilizer on different plats of a field in which *Ophiobolus* had previously been discovered, it was found that commercial fertilizer almost completely eliminated the disease, manure decreased the percentage to a considerable degree, and lime increased the incidence of infection.

The authors believe that this organism, which has already been reported as occurring in New York, Oregon, Indiana, and Arkansas, is widely spread throughout the country and has probably been overlooked because of its little economic importance.

**Wojnowicia graminis on wheat in the United States,** H. H. MCKINNEY and A. G. JOHNSON (*Phytopathology*, 11 (1921), No. 21, pp. 505, 506).—While making a study of the foot rot of wheat, which is attributed to *Ophiobolus graminis*, the authors found mature pycnidia of *W. graminis* quite generally associated with the disease in a number of fields. This fungus has been suspected of being a pycnidial form *O. graminis*. When viewed with the naked eye or hand lens they are apparently indistinguishable, but cultural characteristics show that they differ distinctly, and it is considered rather doubtful whether they are genetically connected.

**The eelworm disease, a menace to alfalfa in America,** G. H. GODFREY (*U. S. Dept. Agr., Dept. Circ.* 297 (1923), pp. 8, figs. 4).—A description is given of the eelworm disease of alfalfa due to *Tylenchus dipsaci*. For the control of this pest the author recommends the plowing up of affected fields and devoting them to nonsusceptible crops for at least three years. In addition to alfalfa, experiments have shown that this nematode will also attack red, white, and alsike clovers, buckwheat, rye, English peas, turnips, and potatoes.

**Clover root rots and powdery mildew,** W. J. YOUNG (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 9-10, pp. 157-160, fig. 1).—A description is given of root rot of clover due to *Sclerotinia trifoliorum* and a more common type of rot attributed to *Fusarium* sp. Powdery mildew of clover, due to *Erysiphe polygoni*, is briefly described.

**Dry-rot of corn,** L. W. DURRELL (*Iowa Sta. Research Bul.* 77 (1923), pp. 345-376, pls. 3, figs. 13).—A study was made of the dry-rot disease of corn caused by *Diplodia zeae*, which is said to be prevalent in Iowa, often causing losses in stand of 15 per cent and 11 per cent damage to seed corn.

The infected seed is said to not germinate at all or to produce weak plants. However, the fungus is not systemic and does not grow into the plant from infected seed. Infection is local, and the fungus may attack the plant through the silk and tips of ears, but the nodes and the ear shanks are considered the chief points of attack. Heavy rainfall at the end of the growing period is said to materially favor the development of the disease.

It has been found that the fungus readily penetrates the modified rag-doll germinator, and that it lives on the cellulose in the soil on old stubble. For the control of the disease a long rotation, the early field selection of seed, and seed germination tests in the spring are considered the most practical means.

**Head smut of corn in Washington**, C. S. PARKER (*Phytopathology*, 11 (1921), No. 12, p. 515).—The occurrence of head smut (*Sphacelotheca reiliana*) on both dent and sweet corn is reported in the State of Washington.

**Experiments in cotton root rot control**, C. J. KING (*U. S. Dept. Agr., Dept. Circ.* 277 (1923), pp. 35-37).—A brief account is given of chemical and cultural tests for the prevention of root rot of cotton. Aeration of the soil through deep digging, flooding with abundant irrigation, and blasting the soil with dynamite had practically no effect on the control of the organism. Applications of sulphuric acid at the rates of from 2,000 to 15,000 lbs. per acre were tested, and while there was a decrease in the number of plants which died from the disease, the following behavior of the organism is believed to indicate that the results obtained were of little value. Lister planting was without beneficial results. Manure treatments in 1920 gave a decrease of 57.9 per cent of dead plants, but conclusions from these results are not considered warranted from a single year's experimentation.

Some studies were made of the fungus, and the author reports the frequent finding of material described by Duggar (*E. S. R.*, 36, p. 146) immediately following prolonged periods of rainy weather in August and September, 1921. In alfalfa fields infected with root rot the conidial mats are said to almost invariably appear in circles in close proximity to the circle of recently dead alfalfa plants.

**Phytophthora infestans on eggplant in the United States**, R. J. HASKELL (*Phytopathology*, 11 (1921), No. 12, pp. 504, 505).—The author reports the occurrence of *P. infestans* on eggplant fruit grown in a field of potatoes. This is believed to be the first report of the occurrence of this fungus on eggplant in this country. It is considered probable that *P. infestans* will not become a serious disease of eggplant in this country, as the range of that crop is not favorable for the development of the late blight fungus.

**Biochemistry of resistance to disease in plants**, J. J. WILLAMAN, C. A. MORROW, and A. K. ANDERSON (*Minnesota Sta. Rpt.* 1922, p. 35).—In a study of the resistance to disease in plants the authors have investigated the metabolism of the flax wilt organism (*Fusarium lini*). The principal products of metabolism are said to be carbon dioxid and alcohol, with smaller amounts of organic acids. About 90 per cent of the carbon added to the medium was thus accounted for.

**Anthrachnose of the garden pea**, F. R. JONES and R. E. VAUGHAN (*Phytopathology*, 11 (1921), No. 12, pp. 500-503, pl. 1, figs. 2).—A description is given of the anthrachnose of pea caused by *Colletotrichum pisi*, which is said to have caused great damage to peas grown for canning purposes in two localities in Wisconsin in 1912 and 1920. The disease is said to be apparently limited in distribution to America. Infection experiments showed that all species of the genus *Pisum* were readily infected, but no host plant outside of this genus was found.

**Cercospora personata on leaves of Arachis hypogea [Bengal]**, S. N. BAL (*Jour. Dept. Sci., Univ. Calcutta*, 3 (1921), But., pp. 4-6, fig. 1).—Peanut (*A. hypogea*) plants in a garden at Ballyganj were observed to be attacked by a disease apparently identical with that known as tikka and caused by *C. personata*.



**Correlation of foliage degeneration diseases of the Irish potato with variations of the tuber and sprout**, A. H. GILBERT (*Jour. Agr. Research* [U. S.], 25 (1923), No. 6, pp. 255-266, pls. 6).—The results are given of observations and experiments undertaken at the Vermont Experiment Station to discover whether there were not some distinguishing characteristics associated either with the earlier or later stages of germination of tubers which might be utilized in determining the presence of mosaic or leaf roll therein during the latter part of the storage period. Many of the conclusions regarding leaf roll of potato by Schultz and Folsom, previously noted (E. S. R., 45, p. 145), were confirmed, especially in the correlations established between spindling sprout and net-necrosis of the tuber and leaf roll of the foliage. In addition to these correlations, the author furnishes evidence relating to tuber germination and foliage symptoms, particularly in relation to retardation in the sprouting of mosaic and leaf roll tubers, bud uniformity in mosaic and leaf roll tubers, the simultaneous occurrence of both mosaic and leaf roll symptoms in the same plant, variation in the progressive seriousness of mosaic infection from season to season, and apical dominance in its relation to disease.

[**Potato diseases in India**] (*Bombay Dept. Agr. Bul.* 102 (1920), pp. 38-75, 84-97, 112-142, pls. 6).—These portions of the bulletin deal with potato diseases and pests through extensive areas indicated, within which the yield of potatoes has been decreased owing to the causes here indicated in some detail.

*The ring disease of potato*, H. H. Mann and S. D. Nagpurkar (pp. 38-57).—Since about 1893 the ring disease (native name, bangdi) has affected potato crops, gradually spreading to almost all parts of India. The disease was considered by Cunningham (E. S. R., 10, p. 266) to be due to a fungus, though described later by Coleman (E. S. R., 22, p. 150) in association with bacteria. It is supposedly the same bacterial disease as that described by Smith (E. S. R., 31, p. 745).

Under the conditions which prevail in the Poona district and probably also in other parts of western India, ring disease is carried almost exclusively by seed. Although the soil may be a source of infection, the disease practically dies out within six months. Every diseased tuber or plant is, however, a dangerous source of infection, as the bacteria are extremely virulent.

The only practicable way yet found of eliminating the disease is by the use of disease-free seed, by means of which the incidence of the disease has been reduced from 53.6 to 1.1 per cent in five generations.

*Other diseases found in the seed*, S. D. Nagpurkar and G. S. Kulkarni (pp. 57-75).—Investigations are recorded as made on potato seed diseases found in western India, including dry rot (*Fusarium* spp., especially *F. trichothecioides* and *F. oxysporum*), Rhizoctonia blight (*R. destruens* and *R. solani*), tuber scab (*Spongospora subterranea*), and potato nematode.

*The storage of potatoes*, H. H. Mann and S. D. Nagpurkar (pp. 84-97).—This work dealt with potato blackheart or heat rot in storage and methods of potato storage through the hot weather.

*A chemical study of heat rot or blackheart of potato*, H. H. Mann and B. M. Joshi (pp. 112-142).—The general conclusions from this work, as presented in considerable detail, are to the effect that the course of heat rot of potatoes, produced when the tubers are stored at a high temperature (above 30° C. or 86° F.), especially in the absence of thorough aeration, is associated with a considerable increase in the ammoniacal nitrogen in the tuber and an increase in the amount of gummy matter and dextrin contained in the potato juice. This is true whether rotting occurs in air, in carbon dioxide or nitrogen, or under complete air exclusion due to dipping in collodion or in paraffin wax.



In air there is, in addition, a considerable increase in the sugars, though this increase is much lower when respiration is prevented, and it is probably not connected with the rotting process.

Rotting is not accompanied by a material increase in the acidity or alkalinity of the juice of the tubers, but when the rotting is marked the amount of enzym catalase is much reduced, until the process is complete and the potato completely soft or rotten. The rotting produced by heat seems to result in a considerable decrease in the respiration of the tuber, as measured by the amount of carbon dioxid produced by the potatoes which have been exposed to the temperatures involved.

The primary purpose of these experiments, namely, to find a method of detecting, by chemical means, the first onset of heat rotting in potatoes, has not been achieved, but the results obtained appear to be of interest and to indicate something of the character of the changes involved in the process studied.

**Phoma insidiosa on sorghum**, C. RUMBOLD and E. K. TISDALE (*Phytopathology*, 11 (1921), No. 12, pp. 513, 514).—In a previous publication (E. S. R., 48, p. 547) the authors tentatively attributed the disease of sorgho to *P. insidiosa*, and subsequent studies and comparisons have confirmed this identification.

**Tomato diseases**, A. WEBER (*Aarbog Gartneri [Alm. Dansk Gartnerfor.]*, 4 (1922), pp. 81-150, pls. 3).—Tomato diseases are dealt with systematically according to modes of causation and agencies involved.

**Pseudoperonospora cubensis on Trichosanthes dioica**, S. N. BAL (*Jour. Dept. Sci., Univ. Calcutta*, 3 (1921), Bot., pp. 1-3, fig. 1).—*T. dioica* is largely cultivated in Bengal, the fruit being greatly relished as a vegetable.

Leaves of patol plants were observed to be attacked by a fungus, other cucurbits growing near not showing the attack, which is confined to the leaves. Small yellow-colored patches were first observed, later becoming brownish yellow and uniting to form larger patches. The older leaves first showed the attack, which rapidly progressed, leaving within 10 days only a tuft of leaves at the tip of the creeping stem.

Prevalent conditions, namely, scant sunshine, cloudy mornings, and comparatively low temperatures, probably favored the development of the fungus. Reports from Pusa show no very serious damage to cucurbits, supposedly due to the fact that the growth of the fungus there is not particularly rapid.

**Fruit diseases**, J. L. SEAL and E. C. STAKMAN (*Minnesota Sta. Rpt. 1922*, p. 100).—Promising results are reported on the use of dehydrated copper sulphate dust for the control of some fruit diseases. In a study of *Sclerotinia* occurring on plums, two biologic forms have been distinguished, and plum varieties are being tested for their resistance to these forms.

**Some factors affecting the production of apothecia of Sclerotinia cinerea**, W. N. EZEKIEL (*Phytopathology*, 11 (1921), No. 12, pp. 495-499).—A study is reported of the production of apothecia from brown rot mummified fruits under different conditions. Under natural conditions apothecia are said to develop during the spring following inoculation, and cold is considered to probably be a factor influencing their production. Burying mummified fruits below the surface of the ground was found to inhibit the production of apothecia, even if their development had already been begun at the time of burying.

**European canker on the Pacific slope**, S. M. ZELLER and C. E. OWENS (*Phytopathology*, 11 (1921), No. 11, pp. 464-468, figs. 4).—The authors report the occurrence of the European canker (*Nectria galligena*) on a number of varieties of apples and pears in Oregon.



**Systemic infections of Rubus with the orange rusts**, B. O. DODGE (*Jour. Agr. Research* [U. S.], 25 (1923), No. 5, pp. 209-242, pls. 7, figs. 7).—A study has been made of the distribution of the gametophytic mycelium of the short-cycled orange rust in the blackberry and dewberry, and of the mycelium of the long-cycled rust in the blackberry, dewberry, and black raspberry.

In the canes of the blackberry in which either rust has become firmly established as a perennial parasite, hyphae are said to be mostly confined to the central pith and to the fundamental tissue of the growing regions. Hyphae penetrate the roots extensively, following the cambium and sieve tubes, and the cortex is also attacked.

New plants arising from the infected roots may be expected to be infected, and the spread of the rust from plant to plant in nature occurs frequently through the connecting roots.

The long-cycled rust was found not to spread often by vegetative means to the tip plants from an infected parent. The infection of very young tip plants by sporidia from teleutospores is said to largely account for the appearance of the rust on new plants. Susceptible varieties of blackberries sown with sporidia on young root shoots are readily infected with the short-cycled rust.

Measures for controlling the orange rusts are suggested, emphasis being laid on a thorough inspection of nursery stock for at least one month after planting, and the complete eradication of plants showing rust.

**Fungicidal sprays and dusts against grape Peronospora**, G. VAGLIO (*Italia Vinic. ed Agr.*, 12 (1922), Nos. 19, pp. 303-305; 20, pp. 320, 321).—Tests as here detailed gave better control of Peronospora with sprays than with powders, though the conditions do not warrant a sweeping general conclusion.

**Outbreaks of Plasmopara viticola in 1921**, P. VOGLINO (*Nuovi Ann [Italy] Min. Agr.*, 2 (1922), No. 1, pp. 72-80).—Detailed accounts are given of the six outbreaks of *P. viticola* on grapevines in the Provinces of Turin, Cuneo, and Novara during 1921, in connection with the records for temperature and moisture (precipitation).

**Commercial control of citrus stem-end rot**, J. R. WINSTON, H. R. FULTON, and J. J. BOWMAN (*U. S. Dept. Agr., Dept. Circ.* 293 (1923), pp. 10, figs. 7).—For the control of the stem-end rot of citrus fruits due to *Phomopsis citri* and *Diplodia natalensis* the authors recommend pruning the trees for the removal of deadwood, in so far as good orchard practice requires, and spraying the young fruit once or twice with a 3-3-50 Bordeaux mixture to which is added 1 per cent oil as emulsion during April or before May 5, under Florida conditions. If the fruit comes from old trees with much deadwood, disbuttoning by gassing is recommended. This will also be found of advantage for other fruit in protecting it against the invasion of the stem-end rot fungi.

**Comparative study of Phytophthora faberi on coconut and cacao in the Philippine Islands**, O. A. REINKING (*Jour. Agr. Research* [U. S.], 25 (1923), No. 6, pp. 267-284, pls. 12, figs. 5).—According to the author, there are in the Philippine Islands two types of bud rot of coconuts, one that is very infectious and caused by a Phytophthora, and a secondary type following some injury and caused primarily by the invasion of bacteria in the weakened tissue. On cacao, cankers are formed on the branches and trunk and a rot produced of the pods by a species of Phytophthora. Comparative studies of these two diseases indicated that both are due to *P. faberi*.

The presence of other strains of Phytophthora on important economic plants in the Philippine Islands is indicated, and the probable identity with the strains on coconut and cacao is pointed out.

**Rhinocladium corticolum on the bark of *Mangifera indica***, S. N. BAL and K. G. BANERJEE (*Jour. Dept. Sci., Univ. Calcutta*, 3 (1921), *Bot.*, pp. 7, 8, fig. 1).—Mango trees (*M. indica*) on the college grounds showed bark discolorations which proved to be due to the fungus *R. corticolum*.

**Control of stem girdle of spruce transplants caused by excessive heat**, C. F. KORSTIAN and N. J. FETHEROLF (*Phytopathology*, 11 (1921), No. 12, pp. 485-490, figs. 3).—Stem girdle of young spruce trees by excessive heat is described, and it is claimed that it can be eliminated in normal seasons or reduced to a negligible amount in seasons having high temperatures. Frequent watering prevents injury to a slight extent, but for the most efficient control of stem girdle the authors recommend inclining the trees slightly to the south at the time of transplanting.

***Cenangium abietis* [on the pine in Pomerania]**, J. LIESE (*Ztschr. Forst u. Jagdw.*, 54 (1922), No. 4, pp. 227-229, fig. 1).—Examination of yearling pine seedlings showed the presence of a fungus agreeing with *Brunchorstia destruens*, the conidial form of *C. abietis*. The latter form has been recorded by Schwarz (*E. S. R.*, 7, pp. 508, 513) as occasionally causing injury of pines, though ordinarily no more than a harmless saprophyte (on dead twigs of *Pinus sylvestris*).

**The connection between *Peridermium strobis* and *Cronartium ribicola*: Is it obligate or not?** J. ERIKSSON (*Arkiv Bot.*, 18 (1922), No. 2, pp. 40, figs. 6).—Examination of evidences as obtained and presented by investigators regarding the carrying over of the blister rust fungus (*P. strobis*) has led to the conclusion that the only way thinkable for the eventual overwinter continuation and spring outbreak of the *C. ribicola* stage is the existence of a latent germ of disease, either as an intercellular mycelium or as an intracellular plasm (mycoplasm) in the tissues of the youngest joints or of the winter buds. With regard to the long period of incubation, the author is inclined to suppose the overwintering of the fungus in a plasm stage.

During the author's studies, continued for 20 years, upon the hollyhock rust (*Puccinia malvacearum*), he has been successful in reducing the vitality of the parasite to a minimum without disturbing the normal life and development of the host plant. It is suggested as possible to find a method of treating young pine seedlings so as to produce immunity.

**The life of *Puccinia malvacearum* within the host plant and on its surface**, J. ERIKSSON (*Phytopathology*, 11 (1921), No. 11, pp. 459-463).—The author describes two races of hollyhocks, one susceptible and the other resistant to early infection by *P. malvacearum*. Both races became badly infected late in the summer. Two forms of spores are described for the fungus that are said to differ in their power to infect the host plants, and this is held to explain the susceptibility of the two races of hollyhocks.

Experiments with a dilute solution of copper sulphate controlled the disease in its early summer phase, but not in the later stage.

## ECONOMIC ZOOLOGY—ENTOMOLOGY.

**Game laws for the season 1923-24**, G. A. LAWYER and F. L. EARNSHAW (*U. S. Dept. Agr., Farmers' Bul.* 1375 (1923), pp. 70).—This is the twenty-fourth annual summary (*E. S. R.*, 48, p. 51) of the Federal, State, and provincial laws and regulations.

**Local names of migratory game birds**, W. L. MCATEE (*U. S. Dept. Agr., Misc. Circ.* 13 (1923), pp. 95, figs. 52).—This publication lists and indexes the vernacular names that have been used for families, species, and other groups of



birds, including American waterfowl, shorebirds, pigeons, doves, and the bobolink or ricebird. A complete index is included.

**Common rodent pests of Wyoming**, A. M. DAY (*Wyo. Farm Bul.*, 11 (1923), No. 4, pp. 27, figs. 6).—This is a popular summary of information.

**Plague infected rats without visible lesions**, C. L. WILLIAMS and T. W. KEMMERER (*Pub. Health Rpts. [U. S.]*, 38 (1923), No. 33, pp. 1873–1881).—The authors report that “in New Orleans the last four plague rats, discovered between May 4 and August 10, 1921, showed very slight evidence of infection and were discovered only by mass or combination inoculation of considerable numbers of rats, and that in Galveston the last nine plague rats, discovered during the period December 20, 1920, to May 28, 1922, showed no signs of plague (except positive smears in one case, May 3, 1921) and were discovered only by gross or combination inoculations of all rats in each day’s catch. . . . There is a suggestion arising from observation of the lesions in the inoculated guinea pig that the failure to produce lesions may be a characteristic of the strain of plague bacilli present after subsidence of the acute epizootic.”

**Manual of entomology**, H. M. LEFROY (*London: Edward Arnold & Co.*, 1923, pp. XVI+541, pls. 4, figs. 179).—This work, which is based upon lectures given as the second of three parts of a course occupying one year of a full training in economic entomology, is arranged by orders, 26 in number.

**Entomological reminiscences: Studies of the instincts and habits of insects**, VIII, J. H. FABRE (*Souvenirs Entomologiques: Études sur l’Instinct et les Mœurs des Insectes. Paris: Libr. Delagrave Éd. Définitive*, 1923, 8. ser., pp. [5]+409, pls. 16, figs. 49).—This is in continuation of the work previously noted (*E. S. R.*, 49, p. 251).

**A useful cage for the rearing of small insects on growing plants**, E. A. HARTLEY (*Ohio Jour. Sci.*, 23 (1923), No. 4, pp. 201–203).—The author describes a specially designed cage of sheet celluloid, which he has found to be very satisfactory for rearing aphids and their parasites and scale insects.

**Potassium cyanid v. hydrocyanic acid**, H. KNIGHT (*Calif. Cult.*, 61 (1923), No. 12, p. 299).—Data are presented based upon investigations conducted by the division of entomology of the California Citrus Experiment Station. The tests conducted confirm observations in the field and lead to the conclusion that under ordinary conditions a hot gas, regardless of the method of generation, offers no advantages.

**The State entomologist law and the pest law of Colorado** (*Colo. State Ent. Circ.* 32 (1921), pp. 15).—The text of these two laws is presented.

**The Destructive Insect and Pest Act and regulations thereunder** (*Ottawa: Canada Dept. Agr.*, 1923, pp. 18).—The Destructive Insect and Pest Act and the regulations promulgated are brought together.

**Twelfth and thirteenth annual reports of the State entomologist of Colorado for the years 1920 and 1921**, C. P. GILLETTE, G. M. LIST, ET AL. (*Colo. State Ent. Circs.* 34 (1921), pp. 56, figs. 26; 36 (1922), pp. 64, figs. 23).—These reports include notes on the more important insect pests of the years 1920 and 1921. Those of the latter year include The Pine Leaf Miner *Recurvaria pinella* Busck and The Spruce Leaf Miner *B. piceaella* Kearf., both by Gillette; The Sunflower Beetle *Cylindrocopterus adspersus* Lec., and The Alfalfa Weevil (*Phytonomus posticus* Gyll.): Progress Report for 1921, both by J. H. Newton; The Pale Western Cutworm (*Porosagrotis orthogonia* Morr.), Long-winged Locust of the Plains, Grasshoppers, and Notes on the Habits and Control of the Western or Mormon Cricket (*Anabrus simplex* Hald.), all by C. L. Corkins; and Notes of Rodent Pests, by W. L. Burnett.

[Report of the Minnesota Station] division of entomology and economic zoology, W. A. RILEY ET AL. (*Minnesota Sta. Rpt. 1922*, pp. 68-73).—In addition to several projects noted below, this report discusses briefly the nutritional requirements of *Tribolium confusum* Duv.; measures protecting flour and other cereal products from insect attack; the effect of physical factors upon insects in freshly cut logs; endoparasites of man and domesticated animals; parasitic and disease-carrying insects and insect allies; and raising rabbits on a large scale in warrens.

In investigations by R. N. Chapman of the possibilities of transmitting an infestation of the granary weevil from infested wheat to macaroni through the process of milling semolina and manufacturing macaroni, durum wheat was infested with eggs of *Calandra* and then milled into semolina, after which it was manufactured into macaroni under carefully checked conditions. No insects or eggs survived either the milling, or the manufacturing of the macaroni. Fumigation of grain in elevators with paradichlorobenzene showed that it is very difficult to remove the odor, and this may exclude its use as a fumigant for grain.

In a study of the temperature of the individual honeybee, by Chapman and G. B. Pirsch, it was found that at bee temperatures lower than 30° C. (86° F.) the body of the bee is warmer than the surrounding air, while at higher temperatures there is a tendency for it to be lower. Records kept by Chapman and L. V. France, including daily observations under various constant and varying temperatures, indicate that the temperature of the cluster of bees does not vary either directly or indirectly with that of the surrounding air.

A careful study of actual forest conditions and of the types and succession of the insects found in slash, by S. A. Graham, has shown that slash burning is not as effective a factor in forest insect control as has generally been believed. Attempts by A. G. Ruggles to control the potato leafhopper by the use of Bordeaux mixture under high pressure, by Sanders dust, and by nicotin sulphate dust gave very unsatisfactory results, which, however, is thought to have been partly due to commencing too late. Studies by Ruggles of the apple maggot, which has become a very serious problem in the State within the last three years, led to the recommendation that three sprayings be made for the purpose of killing the adult flies, one about July 1, the second about July 20, and the third about August 10.

In work with the chicken nematode (*H. papillosa*), by Riley and L. James, the use of concentrated lye at the rate of a tablespoonful to a gallon of a mixture of wheat and oats, which has been highly recommended for removal of tapeworms from poultry, failed to remove either *Heterakis* or tapeworms from experimental birds. A mixture four times as strong was equally inefficacious against *H. papillosa* and tapeworm, but in two cases out of three in which there was also infestation by *H. perspicillum*, 28 and 66 per cent, respectively, of the worms were removed. The severity of the treatment upon the intestinal mucosa was such as to render its use undesirable, even if it had removed the worms satisfactorily. A mixture of 20 parts oil of turpentine plus 1 part chloroform, introduced into the crop by means of a soft rubber catheter in 6-cc. doses, proved from 80 to 100 per cent effective. Oil of chenopodium in doses of 8 to 12 drops was fairly efficient, but the death of the birds showed that the treatment was unsafe. Oil of eucalyptus, as well as powdered areca nut in varying dosage, was wholly inefficient, in spite of the fact that the use of these materials is often recommended. Tobacco decoction failed to remove any worms from 10 young chickens treated.



The widespread prevalence of a serious otocariasis of foxes caused by the mite *Otodectes cynotis* was observed by Riley. The presence of the so-called elk tick, *Dermacentor albipictus*, on moose in the northwestern part of the State was noted for the first time, and it is believed that it is the cause of death of moose in that region. The use of potassium cyanid against pocket gophers, by F. L. Washburn, showed it to be very effective in loam and clay soil, but not in sandy soil.

[Report of the] division of insect and plant disease control (*Wis. Dept. Agr. Bul. 52* (1922), pp. 39–81, figs. 22).—This report includes accounts of The Grasshopper Campaign (pp. 40–43) and Potato Spraying Demonstration Areas (pp. 43–47), both by E. L. Chambers; Cranberry Insect Survey (pp. 47–49); the San José Scale (pp. 50, 51); and Bee Diseases Reduced (pp. 52–58).

**Insect and other pests of 1922**, R. S. MACDOUGALL (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 35 (1923), pp. 90–131, figs. 28).—This is the usual annual report on the more important insect pests of the year (*E. S. R.*, 48, p. 354). In an account on bumblebees, the author reports observations of their interrelation with *Psithyrus* (pp. 111–117).

**Swedish insects: A handbook for the study of economic insects, II, III**, A. TULLGREN and E. WAHLGREN (*Svenska Insekter: En Orienterande Handbook vid Studiet av Vårt Lands Insektfauna*. Stockholm: P. A. Norstedt & Sons, 1921, pt. 2, pp. 177–432, pls. 3, figs. 221; 1922, pt. 3, pp. 433–812, pls. 3, figs. 284).—This completion of the work previously noted (*E. S. R.*, 47, p. 253) deals with Neuroptera (continued), Mecoptera, Trichoptera, Coleoptera, Strepsiptera, Lepidoptera, Diptera, Suctoria, and Hymenoptera. A bibliography of 44 pages and an index arranged by orders are included.

**Report of the assistant director of agriculture (entomology) for the year ended June 30, 1922**, C. C. GHOSH (*[Burma Dept. Agr.] Rpt. Asst. Dir. Agr. (Ent.)*, 1922, pp. 14).—This includes a report on investigation and observation of the pests of paddy, sugar cane, leguminous field crops, oil seeds, fruit trees, etc.

**Insect pests of fruits other than citrus in Southern Rhodesia**, R. W. JACK (*Rhodesia Agr. Jour.*, 19 (1922), Nos. 5, pp. 569–582, pls. 5, fig. 1; 6, pp. 664–674, figs. 3; 20 (1923), No. 1, pp. 59–72, pls. 3, figs. 4).—In this paper the author deals with insects which sting fruit, including 17 species of fruit-piercing moths, and with insects which eat the fruit, attack the foliage, or attack the trunk, branches, or twigs. Mention is made of several important pests that occur in the South African Union but do not occur in this territory.

**Insects attacking forest and shade trees**, H. B. PEIRSON (*Maine Forest Serv. Bul. 1* (1923), pp. 56, figs. 42).—The subject is dealt with under the headings of spruce and fir, white pine, larch, hardwood, and shade-tree insects.

**Earwig as horticultural menace**, A. L. LOVETT (*Better Fruit*, 18 (1923), No. 2, pp. 9, 10, fig. 1).—The earwig, now present in numerous localities throughout the States of Oregon and Washington, is a cause of damage and annoyance through invading residences, as a pest on ornamentals, and by attacking horticultural crops. The insects have been found to enter ripe plums and devour the flesh, leaving the mummied skin and pit hanging on the tree, and have devoured the foliage of fruit trees in the back yards of Portland. Ripe apples have been eaten on the tree, the fruit being rendered unsalable, and the cores of apples have been tunneled into, the earwig being found within the fruit when cut open. They have crowded down between the compact leaves of head lettuce in crates ready for shipment, and have eaten into ripe strawberries where in contact with the soil. Potatoes are seriously attacked; the injury is comparable to that of the Colorado potato beetle, and it has been demonstrated that it will be difficult or impossible to grow potatoes in earwig



infested sections except where rigorous control measures are practiced. Beans, peas, spinach, and other vegetables are likewise injured. A poison bran mash, consisting of sodium fluorid 12 oz., molasses 2 qt., bran 12 lbs., and water about 6 qt., is said to be the accepted control measure. It is pointed out that community action is imperative.

**Grasshopper control in Alberta**, C. G. GROFF (*Agr. Gaz. Canada*, 10 (1923), No. 5, pp. 436-440).—This is an account of control work conducted in Alberta, where over \$500,000 were spent during the season of 1922 in grasshopper destruction, resulting in the saving of crops estimated at approximately \$20,000,000.

**A new species of *Lygus* infesting potatoes in Java** (*Rhynchota, Capsidae*), W. E. CHINA (*Bul. Ent. Research*, 13 (1923), No. 4, p. 447).—Under the name *L. solani*, the author describes a new species which infests the leaves and young shoots of potato plants in Java.

**Bionomics and control of the potato leafhopper, *Empoasca mali* LeB.**, F. A. FENTON and A. HARTZELL (*Iowa Sta. Research Bul.* 78 (1923), pp. 379-440, pl. 1, figs. 25).—The first of the three parts of this account (pp. 380-397) of *E. mali*, the most serious insect pest of the potato in Iowa and probably in the Mississippi Valley, presents a summary of the knowledge of its life history and bionomics, including investigations conducted by the authors.

Part 2 (pp. 398-428) summarizes the knowledge of hopperburn, a disease of the potato produced by *E. mali*, and reports upon the investigations conducted. Experiments by the authors have shown that the date of planting has a decided influence upon the development of this disease, due to the fact that the female leafhoppers prefer partly grown plants for oviposition and are not attracted at the time of the spring flight to smaller vines developed from tubers planted later. Comparative tolerance for the disease was shown to be greatest in potatoes of the Rural New Yorker type, followed by Green Mountain, Irish Cobbler, Early Ohio, and Bliss Triumph, in the order listed, the last named variety being the most susceptible to attack by the leafhoppers.

Part 3 (pp. 428-437), which deals with control, reviews previous investigations and reports upon experiments conducted, much of the data being presented in tabular form. The results of control tests by the authors have been summarized as follows:

"The data from four years' spraying with the insecticides discussed showed that the whale-oil soap nicotin sulphate combination was entirely unsatisfactory. It gave temporary relief by killing 60 to 70 per cent of the nymphs on the vines at the time of application, but it did not affect many of the adults. It neither repelled the adults nor had any action on the thousands of young that hatched from the plants within the following 24 hours. Furthermore, usually enough old nymphs escaped to continue the production of hopperburn. The same difficulties were experienced with the kerosene emulsion, except that with this preparation there was always a possibility of foliage burning caused by the spray as severe as the hopperburn itself.

"On the other hand, three sprays of homemade Bordeaux mixture, 4-4-50 formula, gave good control. If applied properly during June or July at intervals of 10 days to 2 weeks under favorable conditions, the thin film of Bordeaux remained on the plants for some time. Many nymphs that escaped drowning when this spray was applied, or hatched afterwards, died as a result of feeding from leaves covered with this preparation. Furthermore, ovipositing females avoided plants sprayed with this compound. Nicotin sulphate appeared to add nothing to the effectiveness of the spray and only increased the expense. Commercial brands of Bordeaux mixture were reliable as a rule, but they



were nonadhesive. They washed off easily in a heavy rain and were more expensive."

A list of 65 references to the literature is included.

**A new species of psyllid**, F. W. PETTEY (*So. African Jour. Nat. Hist.*, 4 (1923), No. 1, pp. 30-33, figs. 6).—A psyllid which has been known for many years as a minor pest of citrus in the Transvaal, Natal, and the eastern district of the Cape Province, first mentioned by C. P. Lounsbury in 1896 as the citrus psyllid, is described as *Trioza merwei* n. sp.

**An undescribed orange pest from Honduras**, A. C. BAKER (*Jour. Agr. Research* [U. S.], 25 (1923), No. 5, pp. 253, 254, pls. 2).—Under the name *Aleurodicus* (*Metaleurodicus*) *manni*, the author describes a new species of Aleyrodidae collected by W. M. Mann at Ceiba, Honduras, where it occurred abundantly on orange. It is pointed out that the species is controlled in its natural environment in Honduras by the attacks of parasites, but is of potential importance to citrus growing regions of other countries where it may become established without the parasites.

**A brief review of the indigenous Coccidae of the British Islands**, E. E. GREEN (*So. London Ent. and Nat. Hist. Soc. Proc.* 1922-23, pp. 12-25, pls. 4).—The author reports that 127 distinct species have been recorded from Great Britain.

**Scale insects of Florida**, G. B. MERRILL and J. CHAFFIN (*Fla. State Plant. Bd. Quart. Bul.*, 7 (1923), No. 4, pp. 177-298, figs. 101).—This is an illustrated descriptive account of the Coccidae occurring in Florida. The authors list 70 forms of armored scales, 26 forms of soft scales, and 30 mealybugs recognized from the State.

**The gipsy moth: An imminent menace to the forest and shade trees of the State of New York** (*N. Y. State Dept. Farms and Markets, Agr. Bul.* 148 (1922), pp. 58, pls. 6).—This report includes a paper on the History of the Gipsy Moth, by E. P. Felt (pp. 7-22) and a report of discussions on the gipsy moth at the Interstate Conference on Gipsy Moth and European Corn Borer held at Albany in November, 1922. A copy of the resolutions adopted in relation to the European corn borer is included.

**Notes on the small moth borers of sugar cane in British Guiana**, L. D. CLARKE, JR. (*Bul. Ent. Research*, 13 (1923), No. 4, pp. 457-468, pl. 1).—The author deals with the life cycle and habits of Diatraea, of which two species, namely, *D. saccharalis* Fab. and *D. canella* Hmp., are particularly injurious to sugar cane in British Guiana, while a third species, *D. lineolata* Dyar, is sometimes found attacking it.

**[Cutworm studies at the North Montana Substation]**, R. A. COOLEY (*Montana Sta. Rpt.* 1922, p. 21).—In studies, by W. S. Cook, of *Porosagrotis orthogonia*, the principal species of cutworm causing damage in recent years, it was determined that if plowing is done early in the season relatively few of the insects live through to cause damage. In trapping work in 1921, 108,336 moths were captured between August 1 and September 7, while in 1922 only 4,662 were caught over a longer period, namely, between June 16 and October 3.

**Controlling the peach borer with paradichlorobenzene**, O. I. SNAPP (*Miss. State Plant Bd. Quart. Bul.*, 3 (1923), No. 2, pp. 1-7, figs. 7).—This is a discussion of the use of paradichlorobenzene under Mississippi conditions.

**A lepidopteran parasitic on a coccid**, A. L. BEVIS (*So. African Jour. Nat. Hist.*, 4 (1923), No. 1, pp. 34, 35).—The author reports observations of the parasitism of *Ceroplastes* occurring at Umbilo, Durban, by a eucosmid moth,

*Coccothera spissana* Zell. Out of 20 scales collected from twigs, 17 contained living larvae or pupae of the moth.

**The lepidopterous enemies of man, with special reference to species that occur in Britain.** R. ADKIN (*So. London Ent. and Nat. Hist. Soc. Proc.*, 1922-23, pp. 26-47).—This is a general discussion of the subject, in which reference is made to the more important forms.

**Dengue fever.** C. ARMSTRONG (*Pub. Health Rpts. [U. S.]*, 38 (1923), No. 31, pp. 1750-1784, figs. 3).—This paper includes a discussion of the method of spread of dengue fever by mosquitoes, on the rapid spread of the disease as compared to yellow fever, the infectivity of man for the mosquito, etc. A bibliography of seven pages is included.

**Devastations by the columbaci fly** (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 11, p. 944).—In a brief discussion of loss caused by *Simulium columbaczense* Schö., it is reported that in almost all villages and towns in Oltenia County, Rumania, the pastures have been infested by huge swarms of this pest, which have attacked cattle and caused the death of more than 30,000 animals.

**Syrphid larvae as pests.** R. W. DOANE (*Science*, 57 (1923), No. 1487, p. 741).—The author records the loss to spinach growers of the Santa Clara Valley, Calif., in the spring of 1923, of approximately \$400,000, due to the presence of syrphid fly larvae, particularly of *Lasiophthicus pyrastris*, which were feeding on the aphid *Rhopalosiphum persicae* and could not be washed off by the usual process previous to canning the spinach. It is pointed out that spinach which is planted early in the fall and ready for the cannery in March is not infested with the aphids to any extent, and that the syrphid larvae are not to be found until the aphids appear. Early planting thus appears to be the remedy.

**Notes on Indian Muscidae.** R. SENIOR-WHITE (*India Dept. Agr. Mem., Ent. Ser.*, 8 (1923), No. 4, pp. 35-52, pls. 3).—In the first part of this paper notes are given on the Muscidae Testaceae of the oriental region and in the second part notes on Indian Rhiniinae.

**The large and small narcissus flies** (*Verslag. en Meded. Plantenziektenkund. Dienst Wageningen*, No. 29 (1923), pp. 8, figs. 5; abs. in *Rev. Appl. Ent.*, 11 (1923), Ser. A, No. 6, pp. 269, 270).—This is an account of *Merodon equestris*, the large narcissus fly, and of *Eumerus strigatus*, the small narcissus fly, both of which are important pests in the Netherlands.

**The Mexican bean beetle.** A. E. MILLER (*Ohio Sta. Mo. Bul.* 8 (1923), No. 9-10, pp. 154-157, fig. 1).—This is a brief summary of information on the Mexican bean beetle, in which attention is called to its northward spread at the rate of about 150 miles a year, and to its spread from Alabama into central Kentucky, where it was observed during the summer of 1922.

**The normal and pathological histology of the ventriculus of the honeybee, with special reference to infection with *Nosema apis*.** M. HERTIG (*Minnesota Sta. Tech. Bul.* 13 (1923), pp. 109-140, pls. 3).—The author presents a somewhat extended discussion of the normal histology and cytology of the ventriculus of the honeybee, followed by a report of a study of the pathology of the adult honeybee. The diseases of the adult are first considered, followed by discussions of materials and methods; the morphology of the normal ventriculus or midintestine, including its histology and the cytoplasm of the epithelial cells and its inclusions; the relation of cytoplasmic inclusions to intracellular microorganisms; ventriculus infected with *N. apis* Zander; and changes in the ventriculus introduced by *Nosema*. A summary of pathological conditions associated with *Nosema* and a discussion of the pathological condition of the ventriculus not associated with *Nosema* follow. A list of 30 references to the literature is included.



The investigations showed that "throughout infection the epithelial cells retain their identity, the cells not being 'destroyed' at all, strictly speaking, since they disintegrate only after they have reached the lumen. Though the cytoplasm is largely replaced by parasites, the nuclei and cell membranes seem uninjured, though the latter are probably more easily ruptured. Along with destruction of the cytoplasm, changes in relative numbers, of various cell inclusions take place. There appears a tendency toward increased proliferation of epithelial cells, with consequent thickening of the epithelium. With the advance in infection, the formation of striated border and peritrophic membrane becomes seriously deranged. Changes in the appearance and contents of the organ harboring the parasites occur only with heavy infection. The color changes from red or brown to chalky white, and the firmness and elasticity of the tissues are lost.

"From the behavior of infected bees it is seen that these pathological conditions do not immediately produce outward symptoms of disease. In a colony known to harbor the parasites, it is impossible to distinguish from appearance or behavior the infected from the uninfected individuals, except those actually dying of the disease. Since in this latter condition the usual symptoms, i. e., crawling, inability to fly, distended abdomen, etc., are quite as characteristic of disorders not associated with Nosema, microscopic examination is the only certain method of diagnosis. Since it is thus possible for the infection to be in an advanced stage without having any apparent effect on the behavior of the bee, the ultimate pathological effect, namely, the weakening and death of the bee, would appear to be due not to any one of the pathological conditions enumerated above, but to the collective and cumulative effect of some or all of them. Toxins produced by the parasite, if any, would seem to make little or no contribution to the pathological condition, since their effects could be expected to manifest themselves during the growing stages of the parasite. Until more is known of the physiology of the honeybee and of insects in general, the most plausible explanation of the condition, and the one commonly advanced, is that some derangement of the digestive processes takes place, which leads to the malnutrition and hence the weakening and ultimate death of the host."

[Report of the Minnesota Station] division of bee culture, F. JAGER and G. C. MATTHEWS (*Minnesota Sta. Rpt. 1922, pp. 60-65*).—This report includes brief accounts of the progress of queen breeding and rearing, an investigation in controlled mating of queen bees, research into the possibilities of Carniolan bees for Minnesota, a study of the laying capacity of queen bees, the management of bees, summer and winter records of bees in different locations, studies of imported pound packages and nuclei of bees for commercial production of honey, the influence of the size and type of hive on production of honey and of brood, the influence of various kinds of natural and artificial foods in successful wintering of bees, studies in pollen, a study of gathering natural pollen and storing it through the winter for spring use of bees, a study of actual benefit derived from bees as pollinators of plants, bee-disease inspection, and a bee and honey survey of Minnesota.

In experiments with 20 Carniolan colonies and 20 Italian colonies placed side by side in standard sized hives, it was found that (1) Carniolans swarm more than Italians in the same sized hive, (2) on June 1 the brood area stood in proportion of 13 to 16 in favor of the Carniolans, (3) Carniolan colonies are perceptibly larger during the honey flow than Italian colonies, and (4) Carniolans store perceptibly more honey. Four tested, purely mated, Carniolan queen bees produced yellow hybrids after a few weeks, which seems to point



to a possibility of repeated matings. Records kept of 130 colonies showed an average weight of 65 lbs. when put into the cellar on November 12, 1921. The average weight when removed, in April, 1922, was 55 lbs., the average winter consumption being 10 lbs. per colony. Negative results were obtained in the experimental feeding of flour as a pollen substitute. Data obtained during a bee and honey survey of the State showed that beekeeping in the State is improving.

**Bees** (*Canada Expt. Farms, Invermere (B. C.) Sta. Rpt. Supt., 1922, pp. 36, 37*).—Included in this report is a tabulation of the apiary returns for the years 1917 to 1922, inclusive. The Miller feeder is said to have been used exclusively and good results obtained in fall feeding, an average of 17.7 lbs. of sugar per colony, at the rate of 2 parts of sugar to 1 of water, having been fed.

**Beekeeping in Colorado**, N. BOGGS (*Colo. State Ent. Circ. 37 (1922), pp. 15, figs. 7*).—This is a popular summary of information on beekeeping under Colorado conditions.

**The occurrence of diseases of adult bees, II**, E. F. PHILLIPS (*U. S. Dept. Agr., Dept. Circ. 287 (1923), pp. 34*).—This continuation of a previously noted account (*E. S. R., 46, p. 858*) summarizes the reports that have come to the attention of the U. S. D. A. Bureau of Entomology regarding the distribution of Isle of Wight disease throughout the world. The situation in Europe is chiefly discussed, partly because the disease is found there, but especially because importations of queen bees are desired from few, if any, countries other than those of continental Europe. The circular concludes with a discussion of embargoes to prevent introduction of the bee diseases and a list of 70 references to the literature. The texts of regulations governing the importation of adult honeybees into the United States and special rules for the importation of queen bees for experimental and scientific purposes are appended.

**Intensive apiculture and the rearing of queen bees**, A. PERRET-MAISON-NEUVE (*L'Apiculture Intensive et l'Élevage des Reines. Paris: Libr. Inst. Natl. Agron., 1923, pp. XXIV+448, figs. 70*).—This is a practical illustrated text.

**The twinning and monembryonic development of *Platygaster hiemalis*, a parasite of the Hessian fly**, R. W. LEIBY and C. C. HILL (*Jour. Agr. Research [U. S.], 25 (1923), No. 8, pp. 337-350, pls. 5*).—This is a report of studies conducted cooperatively by the North Carolina Experiment Station and the U. S. D. A. Bureau of Entomology. The Hessian fly parasite reported upon is a species which develops both monembryonically and polyembryonically, the adult parasites emerging in late summer from the host puparium.

"An average of 6.31 individuals, often of both sexes, is bred from each puparium. The female parasite deposits a group of from four to eight eggs at one oviposition in the egg and occasionally in the young larva of the host during the fall of the year. Some of the eggs of the same group are inseminated, while others are not inseminated. During maturation two polar bodies are formed in the egg. These unite to form a single polar nucleus in the anterior region of the egg. Maturation is identical in fertilized and unfertilized eggs. After maturation the female pronucleus fuses with the male pronucleus to form a cleavage nucleus, which becomes located in the posterior part of the egg. The female pronucleus of an unfertilized egg is similarly found in the posterior region. Part of the egg containing the cleavage nucleus then becomes differentiated from the remainder of the egg. This differentiated part is the embryonic region, which together with its contained cleavage or embryonic nucleus gives rise to one or two embryos. The remainder of the egg, containing the polar nucleus, is homologous to the trophamnion and paranucleus of previously described polyembryonic insects. Its function is to nourish the



embryos until they are young larvae and can feed for themselves upon the host.

"The embryonic nucleus divides to form two and then four embryonic nuclei. At the same time the polar nucleus divides to form two polar nuclei or paranuclear masses and these divide to form four such masses. The embryonic region of some of the eggs of parasite bodies then divides to form two embryonic regions, and one region together with two of the four paranuclear masses becomes separated from the other, although both may continue development side by side for some time, being held together by host tissues. This division of the parasite body results in the formation of twin germs, each of which develops directly into a blastula, then into a late embryo stage, and finally into a parasite larva. The embryonic region of other eggs does not divide. Such eggs develop a single parasite by the monembryonic process which is similar to that described for other platygastriids. Approximately one-third of the eggs deposited do not develop beyond the cleavage nucleus stage, probably because they fail to become invested by host tissue.

"The twinning development in insects, here described for the first time, is a simple type of polyembryony. On the other hand, the monembryonic development of this parasite is very highly specialized. Since *P. hiemalis* [Forbes] exhibits both types of development, it furnishes a clue to the origin of polyembryony in insects. It is believed that the monembryonic development of some of the eggs and the fact that some of the eggs of a group are inseminated while others of the same group are not will account for the origin of mixed broods of the parasites and the occurrence of single individuals of a sex different from that of the others of the brood."

**On an internal parasite (Hym.-Chalcidoidea) of a thrips from Trinidad,** J. WATERSTON (*Bul. Ent. Research*, 13 (1923), No. 4 pp. 453-455, figs. 2).—Under the name *Tetrastichus thripophonus*, the author describes a new parasite reared by F. W. Urich in Trinidad from larvae of a thrips in the prepupal stage.

**The rat mite attacking man,** F. C. BISHOPP (*U. S. Dept. Agr., Dept. Circ.* 294 (1923), pp. 4).—The author reports that since the spring of 1920, when the first occurrence in the United States of the bloodsucking mite, *Liponyssus bacoti* Hirst, was reported from a department store in Dallas, Tex., reports of similar trouble have been received from various establishments in Dallas and Fort Worth, Tex. The trouble in some instances was acute, in certain instances compelling the abandonment of parts of buildings. A similar occurrence of this mite has been reported by D. L. Van Dine from a small Mississippi town. Observations of the situation in Texas as reported upon indicate that in Dallas mite troubles have been confined to buildings in the business section of the city rather than to residences. Little definite information has been noted concerning the habits and life history of the mite.

All of the infestations investigated by the author have shown the mites to be associated with the brown rat (*Rattus norvegicus*). The comparatively few mites found on the bodies of rats indicates that the mites feed largely on the young or adult rats while they are quiet in their nests and hiding places, and that they detach themselves and remain in such situations. When hungry, however, the mites crawl about freely during the day and night in search of food. The finding of mites in great numbers where rats were abundant and had not been disturbed showed that their scattering is not due to the distribution of their normal host. It is thought possible that the scattering of the mites may be due to a scarcity of young in the nests or the movement of the rats to other nesting quarters, thus driving the mites to seek food. Experiments indicate that the longevity of mites in confinement where food is not

available is 10 days, but greater when the mites are allowed to remain in their natural environment in a building. Both nymphs and adults attack man freely, the bite being distinctly painful at the time the mouth parts are inserted, a sharp itching pain being usually experienced. Usually there is more or less irritation and itching at the site of attack for several hours, along with the development of a small hemorrhagic area, which seldom persists more than two days.

A mixture of anthracene oil 1 part and kerosene 2 parts applied to floors as a repellent has been advised and used with success. Fumigation with hydrocyanic acid gas is thought to be one of the most effective methods of procedure, especially if rats are excluded following the treatment. Pyrethrum when fresh gives relief if used very frequently, but in all cases it seems essential to get at the nesting places of the rats to secure satisfactory control.

**The pharynx and alimentary canal of the hookworm larva, *Necator americanus*, N. A. COBB** (*Jour. Agr. Research [U. S.]*, 25 (1923), No. 8, pp. 359-362, pl. 1).—Facts here presented, based on observations recently made by the author, are given as reasons for regarding the pharynx of the full grown larva of *N. americanus* as somewhat in the nature of a protrusile onchium.

### FOODS—HUMAN NUTRITION.

**Twenty-seventh report on food products and fifteenth report on drug products, 1922, II, E. M. BAILEY** (*Connecticut State Sta. Bul.* 248 (1923), pp. 387-443).—The inspection work reported has included routine analyses of samples of canned clams; diabetic and special foods; lemon and vanilla extracts; bread, pastry, and self-raising flours; ice creams; infant foods; human milk; various spices; tea; and various other foods.

A sample of commercial inulin was found to contain moisture 9.53, nitrogen 0.16, ash 2.58, and direct reducing sugar calculated as levulose 0.79 per cent. The specific rotation at 20° C. corrected for moisture, ash, and protein was —32.9.

The progress report on studies on the cryoscopy of milk (pp. 411-415) is reported on page 112.

**Does buckwheat contain all of the food factors necessary for the growing organism? A. PALLADIN** (*Biochem. Ztschr.*, 136 (1923), No. 4-6, pp. 346-352, figs. 5).—A study is reported of the nutritive value of buckwheat.

When fed as the sole food to growing mice, nutritive failure resulted. When used only as a source of protein, growth ceased after a short time, but was renewed after the diet was supplemented by casein. It is thought that the proteins of buckwheat may be lacking in glutenin and gluten fibrin, but this theory was not tested. Buckwheat was also found to contain sufficient vitamin B, to be lacking in vitamin A, and to have an incomplete salt content, the latter resembling that of wheat, oats, and corn.

**A study of the dietary value of wild rice, C. KENNEDY** (*Minnesota Sta. Rpt.* 1922, p. 34).—This study of the food value of wild rice has shown it to be of similar value to other common cereal grains. Its proteins are of too low a biological value to promote growth in rats when fed at the highest possible level (about 12 per cent). The combination of 7 per cent of wild rice protein and 5 per cent of casein proved adequate for normal growth. The wild rice was found to be deficient in calcium, sodium, chlorin, and vitamin A.

**Jellies and their value in the home, G. B. CARLETON** (*Jour. Agr. and Hort. [Quebec]*, 27 (1923), No. 2, p. 24).—Jelly making is briefly discussed, and suggestions are made for the use of jelly in the home for emergency desserts and for other purposes.



**Increasing the consumption of eggs**, W. A. MAW (*Jour. Agr. and Hort. [Quebec]*, 27 (1923), No. 2, p. 22, fig. 1).—The use of eggs is discussed and some information summarized regarding the culinary value of eggs graded according to the Canadian standard classification of eggs. The experiments referred to were carried on by the School of Household Science at Macdonald College, Quebec.

"Eggs grading as 'specials' are attractive in appearance when cooked alone or in combination with other foods, and give a delicious flavor to the prepared dis. . . . Eggs grading as 'extras' are very satisfactory, giving good results when cooked alone or in combination with other foods. . . . Eggs grading as 'No. 1's' may be used. . . . Eggs grading as 'No. 2's' were not uniform in appearance or flavor."

**The mineral constituents of milk**, W. GODDEN (*Jour. State Med.*, 31 (1923), No. 9, pp. 410-415).—This is a general discussion of the importance of milk from the standpoint of its content of inorganic constituents.

**Studies on the therapeutic application of *Bacillus acidophilus* milk**, H. A. CHEPLIN, H. C. FULMER, and C. O. BARNEY (*Jour. Amer. Med. Assoc.*, 80 (1923), No. 26, pp. 1896-1899).—This is an extension of the observations on the therapeutic value of *B. acidophilus* milk in cases of chronic constipation and mucous colitis (*E. S. R.*, 48, p. 866). The 10 case reports given indicate that variations are to be anticipated in the reaction of different cases to *acidophilus* milk, and in particular that important results are not always to be expected. In the experience of the authors, however, the treatment, if continued, has always led to marked improvement in chronic constipation.

**What our four-year-old ate this week** (*Mod. Priscilla*, 37 (1923), No. 9, p. 36).—The menus for a week are given, with the quantity of each food eaten and the number of calories it supplied. The range was from 1,638 to 1,672 calories per day, and the average for the seven days was 1,637 calories. [The protein content of the diet was not stated, but as computed from the published data it ranged from 45 to 50 gms. per day.]

**Chemical constituents of saliva as indices of glandular activity**, J. L. MORRIS and V. JERSEY (*Jour. Biol. Chem.*, 56 (1923), No. 1, pp. 31-42, figs. 6).—Data are reported in tables and charts on the content of urea, ammonia, amino acids, creatinin, and uric acid in the saliva under different conditions of stimulation. The saliva was in all cases collected from the resting glands, and the output measured in time intervals. A comparison of the composition of the saliva thus collected with that obtained under the stimulus of paraffin chewing showed that in the latter case the secretion is much more irregular in its chemical composition. The increases due to paraffin chewing differ in amount for the various constituents, figures for urea being the least and for uric acid the most disturbed, with amino acids and creatinin lying between these extremes.

The data reported include values for volume and chemical constituents obtained in 8-hour series of  $\frac{1}{2}$ -hour specimens, the volume and uric acid content during 14 consecutive hours, with three breaks of half an hour each for meals of a nonpurin diet, and the volume and chemical constituents after stimulation with acetic acid, pilocarpin, and atropin, and after a nonpurin and purin diet.

The saliva from the unstimulated gland showed irregularity in its ammonia nitrogen content which is thought to indicate that ammonia is not a direct product of the glands, but is formed after the secretion leaves the gland, probably through hydrolysis of urea. The other substances and the total volume showed a tendency toward a general rise through the day, thus pointing to increased physiological activity.

Stimulation of the gland by small amounts of acid as compared with paraffin gave a greater increase in volume, but a lesser increase in the various constituents. The possible explanation advanced for this is that acetic acid acts more locally upon the glands, while chewing exerts a general accelerating effect upon the entire process of filtration from the blood. The action of pilocarpin differed from both the stimulation of chewing paraffin and the action of the acid in that the amino acids were influenced less and uric acid and creatinin more. Similar results were obtained with atropin.

It is concluded that "the variations observed in saliva secretion as a result of stimuli of different kinds bear definite relations to the nature of the activating forces. Final interpretations are not yet warranted, but the selective effects of the stimuli indicate that several factors are involved in the elaboration of the secretion and that these are stressed in different proportions under various stimuli. The factors concerned may be roughly grouped as relating more directly to filtration or metabolism of the glandular tissue. Work, planned to give further evidence leading to interpretation of the problems connected with the elaboration of saliva and the conditions controlling the chemical content, is being carried out by this laboratory on normal and pathological subjects. The data in the present communication seem to justify the working hypothesis that uric acid, more than any other constituent, represents the actual cellular activity and might well serve as an index of the gland metabolism."

**The creatin-creatinin metabolism in human beings and its derangements,** M. BÜRGER (*Klin. Wchnschr.*, 2 (1923), Nos. 1, pp. 33-35; 2, pp. 87-90).—This is a review and discussion of the literature on creatin-creatinin metabolism.

**The production of kidney lesions in rats by diets defective only in that they contained excessive amounts of proteins,** L. M. POLVOGT, E. V. MCCOLLUM, and N. SIMMONDS (*Bul. Johns Hopkins Hosp.*, 34 (1923), No. 387, pp. 168-172, pl. 1, figs. 4).—To determine whether high protein diets have an unfavorable effect upon the kidneys, four groups of young rats were fed diets the protein content of which varied from 31 to 41.3 per cent, but which were satisfactorily constituted in every other respect. The animals were kept on this diet until they reached an age of about 400 days and were then killed and their kidneys subjected to careful examination. Some of the young of four generations were killed at various ages and the kidneys examined in a similar manner. The kidneys of four rats on the stock diet were also examined.

The kidneys of the control animals were normal in every respect, while those of all of the animals on the high protein diet showed marked lesions, the outstanding feature being the formation of large numbers of hyalin casts and intense congestion. Since the animals showed good growth and high fertility, with low infant mortality, on these diets, there is thought to be no other cause than the excretion of excessive amounts of the end products of protein metabolism to which can be ascribed the damage to the kidneys.

**The size of the parathyroids of rats, and the effect of a diet deficiency of calcium,** E. M. LUCE (*Jour. Path. and Bact.*, 26 (1923), No. 2, pp. 200-206, pl. 1, fig. 1).—In a preliminary series of experiments in which rats fed diets with various known deficiencies were killed and measurements made of the size of the parathyroid glands, there appeared to be some enlargement of the gland in young rats fed on a diet deficient in vitamin A, but not in adult rats subjected to the same deficiency except in the case of castrated animals. A more pronounced and consistent enlargement of these glands resulted from calcium deficiency. The effects of this deficiency were made the subject of a



more extensive study. All of the rats fed a diet deficient in calcium showed a consistent enlargement of the parathyroid glands. This was proved to be due to hyperplasia and not hypertrophy of the cells, to have no definite relationship to weight or sex, but to increase progressively with the length of time of feeding upon the calcium deficient diet, and not to be accompanied by corresponding changes in the thyroid gland.

[**Vitamin studies at the Minnesota Station**] (*Minnesota Sta. Rpt. 1922, pp. 38, 39, 40, 41, fig. 1*).—The progress report on vitamin studies at the station includes the following topics:

*Factors influencing the stability of vitamins in human and animal foods.*—Experiments conducted by C. Kennedy and L. S. Palmer have led to the tentative conclusion that there is some diminution in the vitamin A content of June butter after 9 months' storage at low temperature, and that probably the deterioration becomes evident shortly after 6 months.

*Studies on the chemical nature of vitamins A and B.*—Further evidence that vitamin A is not identical with carotin (E. S. R., 45, p. 867) is afforded by studies conducted by Palmer and Kennedy. A diet freed from carotinoid pigments by extraction with hot alcohol and ether and with butterfat decolorized with charcoal as the sole source of vitamin A is said to have retained its growth-promoting value for rats, although the rats would not eat sufficient of such a diet to grow normally.

*The quantitative requirements of laboratory animals for vitamins.*—This report of a study by Kennedy, Palmer, and H. M. Harshaw of the relative values of yeast and wheat embryo extract as a source of vitamin B has been noted previously from another source (E. S. R., 48, p. 759).

*Studies regarding the function of vitamins in the animal body.*—This has been noted in a paper by Palmer and Hoffman (noted below).

Progress in other vitamin studies is noted on page 175.

**The content of linseed oil in the fat-soluble factor A**, A. PALLADIN (*Biochem. Ztschr.*, 136 (1923), No. 4-6, pp. 339-345, figs. 3).—Feeding experiments with white mice are reported, using linseed oil as a source of vitamin A. When fed in amounts as large as from 5 to 10 per cent of an otherwise satisfactory ration, the oil proved unsatisfactory as a source of vitamin A, thus indicating that it contains little, if any, of this vitamin. The seed itself was found to contain a small but appreciable amount of vitamin A.

**On an invariable and characteristic disturbance of reproductive function in animals reared on a diet poor in fat-soluble vitamin A**, H. M. EVANS and K. S. BISHOP (*Anat. Rec.*, 23 (1923), No. 1, pp. 17, 18).—It is noted briefly that "prolongation of oestrous vaginal changes and failure of ovulation occur in 100 per cent of animals reared on diets which are low in vitamin A but which, nevertheless, permit normal growth." This condition was cured by the administration of small quantities of dried alfalfa leaves or butterfat.

**Carbohydrate metabolism in avitaminosis, II-IV**, J. A. COLLAZO (*Biochem. Ztschr.*, 136 (1923), No. 1-3, pp. 20-37, 278-290, figs. 12).—In continuation of the investigation previously noted (E. S. R., 49, p. 565), three papers are presented.

II. *Glycogen and avitaminosis* (pp. 20-25).—In this study the glycogen content was determined of the liver and entire body of pigeons and fowls which had been fed for 20 days on polished rice and a salt mixture, the liver and muscle glycogen content of scorbutic guinea pigs, and the muscle, heart, and liver glycogen content of dogs fed on the diet lacking in all three vitamins. In all cases similar determinations were made on normal and fasting controls.

In all cases on the deficient diet the hyperglycemic state noted in the previous study was accompanied by disappearance of glycogen from the liver and

muscles, while in the fasting animals in a similar state of hyperglycemia the loss of glycogen was much less marked. It is concluded that the various vitamins play the same physiological rôle in carbohydrate metabolism in birds, rodents, and carnivora.

III. *The influence of the addition of glucose in small and large amounts on the blood sugar of normal, fasting, and avitaminous subjects* (pp. 26-37).—This paper reports a study of the effect upon the blood sugar content of normal and fasting dogs and dogs suffering from lack of all three vitamins of the administration of glucose by mouth or by rectal, intraperitoneal, intravenous, and subcutaneous injection.

A striking similarity is to be noted in the blood sugar curves of normal and fasting animals. Large doses of sugar (80 gm.) produced in these animals an immediate but transitory hyperglycemia and small doses a less marked hyperglycemia, with the blood sugar soon returning to normal. In the avitaminous dogs the administration of large doses of sugar caused a much more marked and lasting hyperglycemic condition than in normal animals, while small doses caused hyperglycemia followed by transient hypoglycemia.

IV. *The toxic action of the intermediary metabolism products following the administration of different sugars in avitaminosis* (pp. 278-290).—This paper is concerned chiefly with a discussion of the cause of hyperglycemia as the result of lack of vitamins. Data are presented showing that for animals in a state of avitaminosis glucose, levulose, and galactose are highly toxic, sucrose, lactose, and maltose less toxic, and starch least of all. The author's theory concerning this toxicity is as follows:

In conditions of vitamin deficiency the carbohydrate metabolism is quickly and markedly altered. This is manifested first in an increased catabolism of the carbohydrates of the food and the reserve supplies in the body. This results not only in hyperglycemia but in the formation of toxic intermediary metabolism products in varying amounts, depending upon the kind of carbohydrate fed. These early and severe disturbances in the carbohydrate metabolism are thought to indicate that for the normal metabolism of carbohydrates the cells require vitamins. No distinction is made in the discussion between the various vitamins, but it is noted in conclusion that the addition of 5 gm. of yeast is sufficient to counteract the harmful effect of 10 gm. of glucose, thus implying that it is a question of vitamin B.

**Protein and pellagra**, M. HINDHEDE (*Jour. Amer. Med. Assoc.*, 80 (1923), No. 23, pp. 1685-1689).—This is a general discussion of the theory that pellagra is caused by a deficiency of animal protein in the diet. The work of Goldberger and his associates is analyzed and criticized, and the author's own experience both in long period maintenance on diets containing no animal protein and in the direction of the successful rationing of food in Denmark during the World War is discussed in considerable detail.

The present situation regarding pellagra is compared with the earlier theories concerning beriberi. In the opinion of the author pellagra, like beriberi, is not a question of protein but of vitamins. The use of whole wheat bread and large quantities of potatoes and fresh vegetables is recommended as the best dietary measure for the prevention of the disease.

**Biochemical properties of the blood of pigeons in polyneuritis and starvation**, L. S. PALMER and C. T. HOFFMAN (*Soc. Expt. Biol. and Med. Proc.*, 20 (1922), No. 25 pp. 118, 119).—Data are tabulated on the average composition of the whole blood of 13 normal pigeons, 8 pigeons starved until they had lost 40 per cent of their body weight, 7 pigeons with latent polyneuritis, 16 with acute polyneuritis, 4 which had recovered normal weight following acute poly-



neuritis, and 3 which had starved to a 40 per cent loss of weight after having been restored to normal weight following polyneuritis. The data include the percentage of total solids, total nitrogen, protein nitrogen, nonprotein nitrogen, carbon dioxide content of the plasma, and total erythrocytes and leucocytes per centimeter.

In general the decrease in total solids and in the nitrogenous constituents of the blood and the diminution of erythrocytes would seem to be due to the self-imposed starvation always accompanying the later stages of polyneuritis. It is pointed out, however, that in acute polyneuritis there is not the decline in the relative amount of protein in the blood which is characteristic of simple inanition in its advanced stages.

**The rôle of parental nutrition in the causation of rickets**, A. H. BYFIELD and A. L. DANIELS (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 5, pp. 360-362).—This is a general discussion based on the literature on the subject, observations of the authors concerning the production of rickets in rats, and a study of the nutritive and economic conditions in England previous to a marked increase in the incidence and severity of rickets during the early part of the seventeenth century.

In the experience of the authors it has been impossible to produce gross rickets in rats by means of a faulty diet until the second generation, provided the parent stock had received an abundant diet. The historical survey tended to show that "the economic changes with their direct effects on the manner of living of the English people were operative for at least two generations before rickets became so widespread as to assume the proportions of a definite clinical entity." These observations are thought to indicate that faulty parental nutrition is one of the chief causes of human rickets.

**The influence of removal of sexual glands on the skeleton of animals kept on normal or rickets-producing diets**, V. KORENCHESKY (*Jour. Path. and Bact.*, 26 (1923), No. 2, pp. 207-221).—Using the same general plan, the investigation previously noted (*E. S. R.*, 48, p. 466) has been extended to a similar study of the effect of castration on the histological structure and chemical composition of the skeleton of rats on normal and on rickets-producing diets.

The results of the chemical and histological examination of 32 castrated and 22 control rats showed no essential influence of castration on the skeleton of growing rats fed on a normal diet, and no perceptible change in the degree and character of rickets produced in growing rats by deficient diets.

**Spontaneous rickets in rats**, V. KORENCHESKY (*Jour. Path. and Bact.*, 26 (1923), No. 2, pp. 222, 223).—This is a brief note concerning the development of spontaneous rickets in some stock rats which had been kept in crowded quarters and were fed with no special care on diets deficient in fats, salts (chiefly calcium and phosphorus), and the fat-soluble vitamin. All of the rats developed rickets in varying degrees from the severe to the mildest form. A bacterial examination of the blood, liver, spleen, and bone marrow of many of the cases gave no positive results. This outbreak of rickets is thought to confirm the importance of the deficiency of calcium salts and the fat-soluble vitamin in the production of rickets, and the belief that the disease can not be induced by microorganisms. The necessity is emphasized of careful attention to the maintenance and diet of animals to be used subsequently for experimental work, especially in connection with rickets.

**The therapeutic value of egg yolk in rickets**, A. F. HESS (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 1, pp. 15-17, figs. 3).—The author recommends the use of egg yolk as an antirachitic supplement in infant feeding. The yolk of one

raw egg added to the usual milk formula of infants over two months of age or of half a yolk to that of infants under two months of age is said to be well tolerated, to promote gain in weight, to protect against rickets, and to maintain the normal level of blood phosphates.

The potency of egg yolk as a preventive and curative agent in rickets has also been tested with young rats on the Sherman-Pappenheimer low phosphorus diet. The addition to this diet of 0.25 gm. daily of egg yolk was sufficient to protect the animals from rickets, while with larger amounts, from 0.3 to 0.5 gm. daily, there was a marked increase in weight. The rats receiving the egg yolk had a higher percentage of blood phosphorus than the controls, and the amount increased with the amount of egg yolk fed. In curative experiments somewhat larger amounts were required than in preventive tests. Calcification of the bones was brought about in 8 days with 0.5 gm. of egg yolk daily. Similarly, with children the curative results were not so marked as the preventive.

Egg white, as determined by rat experiments, not only seemed to have no antirachitic properties, but to increase the rickets-producing quality of a dietary.

**The antirachitic influence of egg yolk,** H. CASPARIS, P. G. SHIPLEY, and B. KRAMER (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 10, pp. 818, 819).—Further evidence is given of the value of egg yolk in the healing of rickets in children and of experimental rickets in rats. Seven colored children suffering from severe rickets were given a diet of farina and milk, with one or two eggs apiece daily. As shown by roentgenograms, definite healing of the rickets began within three weeks after eggs had been added to the diet, and in all cases the level of inorganic blood phosphorus rose to normal values. In one case in which eggs were refused for several weeks, no improvement in the rickets on the farina and milk was noted.

Rats which had developed rickets on a diet low in phosphorus and fat-soluble A and high in calcium showed definite signs of healing in six days following the addition of 10 per cent of egg yolk to the diet. This was accompanied by a rise in the inorganic phosphorus of the blood serum, while the calcium concentration remained unchanged.

**The production of scurvy in the guinea pig and young rabbit by means of a new diet complete and biochemically balanced with the exception of containing no vitamin C,** LOPEZ-LOMBA and RANDOIN (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 15, pp. 1003–1006, fig. 1).—The basal scurvy-producing diet recommended has the following composition: Navy bean flour 84, granulated brewery yeast 3, butterfat 4.5, calcium lactate 5, sodium chlorid 1.5, and filter paper 2 gm. The bean flour is cooked in water for some time and then made up with the other ingredients into a thick paste.

The reason for the use of each ingredient of the ration is discussed, and typical growth curves are given for guinea pigs on this ration with and without the addition of 3 cc. of lemon juice. On the basal diet supplemented by lemon juice guinea pigs are said to grow at a normal rate, while on the ration alone there is a short period of rapid growth, followed by a loss in weight and the characteristic symptoms of scurvy.

**Study of scurvy produced by a complete and biochemically-balanced ration deprived only of vitamin C,** J. LOPEZ-LOMBA and RANDOIN (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 22, pp. 1573–1576, fig. 1).—This paper summarizes the symptoms and anatomical findings of experimental scurvy induced in young guinea pigs and rabbits and in adult guinea pigs by the basal ration noted above. In the experimental work upon which these findings are based, the change from the normal to the experimental diet was made gradually with



a view to preventing loss of appetite and consequent loss in weight until after the development of scurvy.

In young guinea pigs there is a rapid growth for a variable time, depending upon the initial age of the animal. After an abrupt cessation of growth there is a period of oscillation for several days, followed by a rapid loss in weight. With young rabbits the growth period extends for several weeks and is then followed by the same rapid loss in weight. In adult guinea pigs the weight is maintained for a variable period of time, following which there is a rapid loss in weight. Adult rabbits are not affected by deprivation of vitamin C. The usual symptoms of scurvy are reported. It is emphasized that there is no loss in appetite until shortly before death.

A comparison of the weight of various organs of scorbutic and normal adult guinea pigs showed that in scurvy there is an appreciable increase in the weight of the adrenal and thyroid glands, no change in the weight of the kidneys and spleen, a slight loss in the weight of the testicles, a loss of about 28 per cent of the weight of the liver, and more than 50 per cent of the thymus.

**Botulism and food preservation (the Loch Maree tragedy)**, G. [R.] LEIGHTON (*London: W. Collins Sons & Co., Ltd., 1923, pp. XIII+237, pls. 10*).—This volume consists of 11 chapters on botulism in general, followed by 5 chapters in which a detailed account is given of the outbreak of botulism at Loch Maree, Scotland (*E. S. R.*, 49, p. 862).

## ANIMAL PRODUCTION.

**Range and pasture management**, A. W. SAMPSON (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1923, pp. XIX+421, pl. 1, figs. 123*).—This book deals with the practical care and management of range and pasture lands in the United States. Among the phases discussed are grazing and grazing control in the national forest, State, and private grazing lands; signs of decline in forage yields and methods of reseeding or maintaining forage plants; descriptions of the leading introduced forage plants and the common poisonous plants, with symptoms and remedies for poisoned animals; protection of forage and timber lands and the effects of burning over lands on the amount of forage produced; consideration of watering places and the grazing capacity of the lands; research methods in range and pasture revegetation; and suggestions for instruction in pasture management and livestock production.

**The American livestock and meat industry**, R. A. CLEMEN (*New York: Ronald Press Co., 1923, pp. IX+872, pls. 22, figs. 21*).—A complete history and description of the American livestock industry is given in four parts, the pre-refrigeration period, the refrigeration period, some livestock financing and marketing problems, and the packing industry in its public relations. The American livestock and meat industry is reviewed from its very beginning and as it gradually moved westward, to the present time when it has become one of the largest industries of the United States. The early livestock markets and packing plants are described, with brief sketches of the men who were the first packers. The development of the western range cattle industry, refrigeration and consequent growth of the packing houses due to the development of the fresh meat trade and methods of distribution in this country and abroad, Federal meat inspection, the manufacture of by-products, and methods of cost accounting in packing houses are taken up in turn. The cycles and methods of marketing and financing livestock and the resulting problems are discussed. The results of experiments in regulating markets during the World

War and attempts to solve other problems of marketing are reported. The labor problem of the packing houses and Government regulations are described, as well as numerous other relations of the packing industry to the public.

**Supplying Britain's meat,** G. E. PUTNAM (*London, Calcutta, and Sydney: George G. Harrap & Co., Ltd., 1923, pp. 169, pls. 16*).—The economic aspects of the meat industry of Great Britain are considered, and statistical data are given on the imports, production, and supply of meat in the United Kingdom. A large portion of the book deals with the position of the American packer in supplying Great Britain with meat.

**Digestion experiment with cattle feeds,** J. B. LINDSEY, C. L. BEALS, P. H. SMITH, and J. G. ARCHIBALD (*Massachusetts Sta. Bul. 216 (1923), pp. 53-62*).—The digestion coefficients, as determined for cattle feeds with sheep during the past 4 years, are given as a concluding report of this investigation, which has been pursued for 30 years at the station. As in the previous experiments (E. S. R., 39, p. 171), the basal ration consisted of English hay or English hay and gluten feed. The plans were similar to those for the preceding studies. In addition to the basal rations, dried apple pomace (E. S. R., 47, p. 273), and oat feed and hulls (E. S. R., 46, p. 476), coefficients of digestibility were determined for several feeds as reported in the table below, and also for peanut skins, the results for which were unsatisfactory.

*Coefficients of digestibility of feeding stuffs.*

Feed.	Number of tests.	Number of animals.	Dry matter.	Protein.	Fat.	Fiber.	N-free extract.	Ash.
			<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Barley screenings....	2	2	57.45	73.92	9.48	38.45	62.14	22.51
Carrots (with hay)...	3	2	77.31	72.06	67.62	64.83	92.16	11.75
Carrots (with hay and gluten feed)....	4	2	80.31	56.40	16.78	105.27	89.60	42.94
Coffee refuse.....	1	1	26.95	11.48	75.36	12.76	32.03	97.18
Cottonseed meal.....	2	2	72.29	82.19	98.03	23.29	80.71	83.95
Feterita.....	2	2	86.65	92.66	89.59	-----	89.63	155.98
Peanut meal.....	2	2	77.58	83.14	90.89	53.48	80.81	-----
Peanutshells.....	2	2	29.01	68.54	83.58	-----	42.47	23.43
Velvet bean feed.....	4	4	76.42	74.29	79.88	62.46	84.68	31.55
English hay.....	19	9	58.82	51.21	39.75	65.03	50.09	36.13
Gluten feed.....	9	6	86.68	85.78	74.18	92.08	91.10	-----
Dried apple pomace..	7	4	68.11	-----	36.05	69.05	76.06	-----

**Further report on the nutritive value of certain Australian grasses,** M. H. O'DWYER (*Linn. Soc. N. S. Wales, Proc., 47 (1922), pt. 4, pp. 516-518*).—Chemical analyses of the nutritive value of Australian grasses have been reported<sup>1</sup> for a stage of growth halfway between the time when the plant begins to shoot the early flowering period. Analyses are reported in this paper of the following grasses at the early flowering period and when the seed is well set: *Andropogon intermedius*, *Danthonia pilosa*, *Eragrostis leptostachya*, *Panicum prolutum*, *P. decompositum*, *Pollinia fulva*, and *Schedonorus hookerianus*.

**Asphodel as a food for animals,** H. MARCHAND (*Bul. Soc. Hist. Nat. Afrique Nord, 13 (1922), No. 6, pp. 202-205, fig. 1*).—Extracts of different parts of the asphodel plant were found not to be poisonous to animals or men, and the tubercles are recommended for livestock feeding in times of famine. One cock receiving a ration of tubercles and barley gained 205 gm. in three months as compared with a gain of 415 gm. by another bird on a check ration.

<sup>1</sup> Linn. Soc. N. S. Wales, Proc., 46 (1921), pt. 2, pp. 239-251.



**The chemical composition of chaff, grain, and vegetables from the middle Volga region,** D. LISKIER (*Zhur. Opytn. Agron. Tugo-Vostoka (Jour. Expt. Landw. Südost. Eur.-Russlands)*, 1 (1922), No. 1, pp. 73-88).—The German abstract of this article states that analyses of chaff and straw; barley, oat, rye, and corn grains; and cultivated vegetables raised in the Volga region differed in certain respects from the analyses of like crops reported in western Europe and America.

**Report on commercial feeding stuffs, 1922,** E. M. BAILEY ET AL. (*Connecticut State Sta. Bul.* 249 (1923), pp. 445-475).—This contains the report of the official analyses of samples of feeding stuffs for 1922, including further information similar to that given in the previous report (E. S. R., 47, p. 570).

**Michigan commercial feeding stuffs** (*Mich. Dept. Agr. Bul.* 20 (1922), pp. 73).—The guaranteed and found analyses of 338 samples of feeding stuffs collected in Michigan from June 1 to September 30, 1922, are given, as well as lists of the brands of feeds registered and other miscellaneous information dealing with the legal requirements and definitions of feeding stuffs.

**Commercial feeds, 1922,** J. O. HALVERSON and L. M. NIXON (*N. C. Dept. Agr. Bul.*, 1923, *Agr.*, pp. 47).—The guaranteed and found analyses of 328 samples of feeds analyzed in North Carolina during 1922 are given, as well as other information on the regulations and definitions of feeding stuffs sold in the State.

**Commercial stock feeds, 1922.—Report of inspection work,** F. B. KUNST (*W. Va. Dept. Agr. Bul.* 57 (1922), pp. 75).—The guaranteed and found analyses of samples of feeding stuffs inspected during the year ended June 30, 1922, are reported in detail, as well as the text of the West Virginia feed law and definitions and compositions of feeding stuffs.

**The technique of breeding rats for feeding experiments,** G. A. HARTWELL and E. C. and V. H. MOTTRAM (*Biochem. Jour.*, 17 (1923), No. 2, pp. 208-215, figs. 3).—This is an account of the methods used by the authors in breeding rats for experimental purposes. The rats produced are large and healthy animals which make rapid growth under normal conditions.

The plan has been to select a few strong and healthy rats, preferably black and white piebalds and albinos, for a foundation stock, from which the future animals are produced by inbreeding. A north room, without too many windows, which is kept between 60 and 70° F., is recommended for housing. Wooden or metal cages may be used, but the wood is more difficult to free of diseases and parasites, though the rats seem to like it better. The young females are bred at six months of age by putting 4 males with 16 females in a large cage. Just before parturition they are removed and placed in individual cages until weaning at 21 days. Bread and milk and table scraps are recommended for feeding. Frequent handling of the animals from birth makes them more disposed to be handled later in life. Suggested methods of treating animals for scab and mange are also given.

**[Feeding experiments at the Minnesota Station]** (*Minnesota Sta. Rpt.* 1922, pp. 58-60).—The results of several feeding experiments are reported, which include those previously noted (E. S. R., 48, pp. 72, 661).

**Swine feeding investigations,** E. F. FERRIN and M. A. McCARTY.—A comparison of growing and fattening fall and spring pigs has been carried on with 30 1920 fall pigs, 60 1921 spring pigs, and 30 1921 fall pigs. The results indicate that fall pigs properly cared for make practically the same gains as spring pigs and require very little more feed per 100 lbs. of gain, but it is necessary to feed them more high protein feeds than are required by spring

pigs on pasture. Oil meal was not a satisfactory substitute for tankage even with the addition of semisolid buttermilk.

**Wintering ewe lambs**, P. A. Anderson and R. Aune.—A ration of corn silage, clover hay, and grain (corn, oats, and oil meal 3:3:1) fed at the rate of 1 lb. per day was more efficient than rations containing only corn or oats or mixtures of the two with and without bran.

[Experiments with beef cattle at the Montana Station], C. N. ARNETT (*Montana Sta. Rpt. 1922*, pp. 16, 17).—The 1921 calf crop was divided into two lots, one lot receiving alfalfa hay only during the 147-day wintering period, whereas the other lot received alfalfa hay and sunflower silage. The average daily gains per head made by the two lots during this period were 1 and 1.1 lbs., respectively, and the calculated daily costs of the rations 6.4 and 6.5 cts. The condition of the calves was practically the same, but during the following summer while on bunch grass mountain range the calves which had been wintered on alfalfa hay only gained an average of 200 lbs. in 140 days, whereas the other lot gained 177.8 lbs. per head in the same time.

**Fattening calves, yearlings, and two-year-olds**, G. BOHSTEDT (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 9-10, pp. 131-138, figs. 10).—In continuing the comparative feeding tests with yearlings and 2-year-old steers (E. S. R., 48, p. 663) during 1922-23, 20 calves, 20 yearlings, and 20 2-year-old steers were fed on daily rations of 2 lbs. of oil meal, with corn silage and mixed hay according to appetite. One-half of the steers of each age were full fed corn, whereas the others received only one-half as much corn. The feeding period for the calves lasted 175 days, for the yearlings 147 days, and for the 2-year-olds 119 days. The average daily gains of calves full fed corn were 2.19 lbs. and those half fed 2 lbs. The yearlings receiving the full feed of corn made average daily gains of 2.42 lbs. and those receiving the half feed 2.01 lbs. The 2-year-olds full fed on corn made average daily gains of 2.81 lbs. and those receiving the half feed of corn 2.31 lbs. The steers receiving the full feeds of corn sold for 75 cts. more per 100 lbs. than those that received the half feed of corn in the calf and 2-year-old lots and for \$1.25 more in the yearling lot. The younger cattle required less feed for the production of gains than the older ones, but those receiving full feeds of corn were more profitable in all cases.

**Alfalfa and silage for fattening cattle**, G. BOHSTEDT (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 9-10, pp. 139-144, figs. 6).—Three lots of 4 heifers and 1 steer each, averaging 19 months of age were fed for 10 weeks on an average daily ration of 9.4 lbs. of alfalfa hay and 22.2 lbs. of silage per head, during which time they made average daily gains of 1.41 lbs. In the next 126 days one of the lots, continued on the same feeds with an increase in the proportion of silage, gained an average of 1.16 lbs. per head daily. A second lot, which received additional feeds of 2 lbs. of oil meal per head daily, gained 1.46 lbs., and the third lot, receiving a full feed of corn in addition to the silage and hay, gained an average of 2 lbs. per head daily.

A study of the results of the test showed that the corn and oil meal not only produced better gains, but the selling price and profits from the steers were likewise greater.

**Pennsylvania cattle feeding experiments**, W. H. TOMHAVE (*Penn State Farmer*, 16 (1923), No. 9, pp. 227, 237).—The 1922-23 steer feeding tests at the Pennsylvania Experiment Station were conducted similarly to those in previous years (E. S. R., 49, p. 268). Five lots of 2-year-olds, weighing about 770 lbs. each, were fed for 140 days on the following daily rations: Lot 1, 19.91 lbs. of corn silage, 12.51 of shelled corn, 4.18 of corn stover, and 2.15 lbs. of cottonseed meal; lot 2 same as lot 1, with the substitution of cane molasses for 30



per cent of the shelled corn; lot 3, 7.77 lbs. of mixed hay, 12.51 of corn, and 2.15 lbs. of cottonseed meal; lot 4, 11.74 lbs. of mixed hay, 8.82 of shelled corn, 3.75 of cane molasses, and 2.15 lbs. of cottonseed meal; and lot 5, 46.61 lbs. of corn silage, 2.87 of corn stover, and 2.11 lbs. of cottonseed meal. The average daily gains and calculated cost per 100 lbs. in the different lots were, respectively, 2.45 lbs. and \$11.65, 2.11 lbs. and \$13.25, 2.15 lbs. and \$12.71, 2.17 lbs. and \$13.50, and 2.03 lbs. and \$8.83. Hogs followed the steers in lots 1 to 4. The valuation per 100 lbs. placed on the lots as indicating the quality of finish were for lot 1 \$9.25, lot 2 \$8.90, lot 3 \$8.80, lot 4 \$8.60, and lot 5 \$8.75. Including the returns from the hogs, lots 1 and 5 made profits of \$5.60 and \$7.49 per head, respectively, whereas there were losses in lots 2, 3, and 4 of \$1.81, \$0.65, and \$6.68 per head.

**Memorandum on the cattle industry of Southern Rhodesia** (*Rhodesia Agr. Jour.*, 18 (1921), No. 3, pp. 237-314, pls. 2).—This is essentially a monograph of the beef cattle industry of Southern Rhodesia, prepared by a committee to familiarize any persons interested or likely to invest capital in the production or marketing of beef, with the conditions existing in that country and the possibilities for further development.

The country is described in detail, and statistics showing the number and exports of cattle during past years and estimated for 1922, 1923, and 1924, the breeds of cattle and methods of management, transportation facilities, markets, and existing future outlets for beef are thoroughly discussed.

**[Wintering ewe lambs at the Montana Station]**, C. N. ARNETT (*Montana Sta. Rpt.* 1922, p. 17).—Three rations were compared for wintering ewe lambs. The amounts of the feeds were adjusted to produce like gains in all lots, and the calculated daily costs of the different rations per lamb were alfalfa hay alone 1.18 cts., alfalfa hay and whole oats 1.13 cts., and alfalfa hay, oat straw, and wheat screenings 0.83 cts. The results of the study indicated that 1 lb. of oats was equal to 3.55 lbs. of hay, and that 1 lb. of wheat screenings and 1.23 lbs. of oat straw were equal to 2.41 lbs. of hay.

**Place of sheep on western Washington farms**, C. M. HUBBARD (*Western Washington Sta. Bimo. Bul.*, 11 (1923), No. 4, pp. 82, 83).—A popular appeal for more farm flocks in western Washington.

**[Fattening pigs at the Montana Station]**, C. N. ARNETT (*Montana Sta. Rpt.* 1922, pp. 17, 18).—The results of comparisons of different methods of feeding barley to pigs indicated that dry whole barley produced slower gains than when the barley was soaked for 24 hours or ground. It is deemed practical to feed dry whole barley when the cost of grinding exceeds 10 per cent of the value of the grain. Preliminary work on the entire cost of producing 200-lb. pigs indicates that brood sows producing 1 or 2 litters per year can be carried in good condition on 4.1 lbs. of ground barley and 1.7 lbs. of good alfalfa hay per day. A ration of 2.8 lbs. of ground barley and 10.9 lbs. of beets was also satisfactory. Sows farrowing fall litters, however, require somewhat more feed to bring them to desirable condition at farrowing time in the spring.

**Soy beans and soy bean oil meal for pigs**, W. L. ROBISON (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 9-10, pp. 149-153).—Several experiments with swine are reported in which raw and cooked soy beans and soy bean oil meal have been compared with tankage as supplements to corn for fattening hogs. The pigs receiving the corn and tankage rations made slightly better gains than those receiving raw soy beans without corn, but when cooked soy beans were fed with minerals the gains exceeded those made by tankage. Pigs receiving soy bean oil meal as a supplement to corn, with minerals, also gained slightly



more rapidly than those receiving tankage. The necessity of feeding minerals with soy beans is emphasized.

**Soft oily bacon.—Its cause and prevention**, F. W. JACKSON (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), No. 3, pp. 261-267*).—By means of chemical tests the relative tendency of the oils of different feeding stuffs to produce soft fat in pigs has been determined according to the number of parts by weight of firm pig fat that would furnish an even blend having a standard softness when mixed with 10 parts of the oil in question. The feeding stuffs are then rated according to their tendency to produce soft pork, based on the softening power of the oil and the amount of the oil in the feed.

**On the effect of deficiency of iron in the diet of pigs (preliminary communication)**, J. P. MCGOWAN and A. CRICHTON (*Biochem. Jour., 17 (1923), No. 2, pp. 204-207*).—An account is given of the occurrence of pathological conditions resembling cottonseed meal poisoning in 3 to 4 weeks old pigs in a large pig breeding establishment. The practice had been to pasture the sows to within two weeks of farrowing time, when they were confined to a pen and received a ration of fish meal, corn, and brewers' offal. The pigs thrived until they were 3 or 4 weeks of age when they became dull and listless, followed by the development of a spasmodic jerking of the diaphragm and with death usually resulting.

A post-mortem examination showed that the pericardial, pleural, and peritoneal cavities and lungs contained large amounts of fluid. The blood was watery and pale, the hemoglobin being about 15 per cent and the erythrocytes about 3,000,000 per cubic millimeter. Fatty degeneration had occurred in the heart muscle, liver, and kidney. Where partial recovery was effected adhesions occurred. The sows also became emaciated.

It was concluded that a deficiency of iron in the diet was the cause of the trouble. Large doses of ferric oxid were given in the feed, and the diseased pigs showed signs of recovery and the young pigs developed without evidence of the diseased condition. The hemoglobin of the blood rose in three weeks to 70 to 80 per cent.

The relationship of these symptoms to cottonseed meal poisoning and other diseases is noted, and it is intimated that a lack of iron may also be a contributing factor in those cases.

**Raised orphan pigs.—I, Protein modifications of cow's whole milk, frequency of feeding, nutritive ratio studies**, J. M. EVVARD, G. V. GLATFELTER, and Q. W. WALLACE (*Iowa Sta. Research Bul. 79 (1923), pp. 441-492, figs. 3*).—This is a more detailed report of a portion of the studies on methods of feeding orphan pigs (*E. S. R., 49, p. 774*), dealing with protein modifications of cow's milk and the nutritive ratio of the rations of young pigs. The first part of the bulletin consists of a discussion and a review of the literature on the relative completeness and desirable modifications of cow's milk as a food for infants and a food for young pigs.

In the first experiment described, 14 12-day-old Poland China pigs were divided into lots of 2 each and fed whole milk at the rate of 2 to 3 lbs. per pig per day for 30 days and 3 lbs. per day for the succeeding 20 days. Shelled corn, meat meal tankage, and block salt were self-fed to each lot, and sufficient of the following feeds were added to the whole milk in the different lots to supply 1 and 2 per cent of protein in addition to that supplied by the milk: Casein, blood meal, and linseed oil meal. The pigs were fed milk 4 times a day during the first 30 days and 3 times a day during the succeeding 20 days, after which a disease resembling pneumonia developed and the test was discontinued.



The range of the average daily gains made by the pigs on the different rations was from 0.448 to 0.588 lb., the check lot (milk only) making the largest gains, followed in order by the lots receiving 3 per cent protein in the form of casein, blood meal, and linseed meal, then in turn by the lots receiving 1 per cent protein from the same feeds and in same order. The largest amounts of shelled corn and meat meal were consumed by the check lot and the smallest amounts by the lots receiving linseed meal. The authors state that the occurrence of the diseased condition of the pigs was probably due to faulty nutrition. The pigs receiving 3 per cent linseed meal had markedly deformed legs and were not as growthy as the others.

Another test was carried out with 7 18-day-old pigs, individual pigs being fed the same rations as were given to the different lots in the previous experiment. The 2 pigs receiving the casein supplements led in average daily gains, making 0.888 and 0.85 lb. per day on the 3 and 1 per cent protein rations, respectively. The pigs receiving 3 and 1 per cent protein from linseed oil meal made average daily gains of 0.817 and 0.783 lb., the latter gain being equaled by the pig receiving 3 per cent protein from blood meal. The check pig gained an average of 0.772 lb. per day, whereas the pig receiving 1 per cent blood meal protein only gained 0.725 lb. per day. The linseed oil meal pigs in this experiment, as in the preceding one, were paunchy and not as growthy as the others, though their coats were slick. The gains made by the pigs from 60 to 90 days, which was after weaning, were greater and more economical for the pigs which had received the 1 per cent protein supplements. The casein lots not only made the best gains throughout the entire 90 days of feeding, but they were smoother and more uniform.

In another experiment the gains made by lots of 2 pigs each full fed whole milk 3 and 7 times a day, respectively, with access to tankage and corn in self-feeders, were compared. The average daily gains were slightly greater with 7 times a day feeding, but more shelled corn and tankage were consumed and less milk was required to produce a unit of gain by the pigs fed 3 times daily. The authors recommend feeding 5 or 6 times daily to very young pigs, with gradual reduction to 3 times daily when the pigs get nicely started. Regularity of amount and time of feeding are also very desirable.

To furnish information on the nutritive ratio of the rations of small pigs, a study was made of the feeds consumed by the pigs receiving milk only in addition to corn and tankage self-fed in the above experiments. The nutritive ratios in each case were calculated for 10-day periods. Similar data are reported for another lot of 6 pigs fed 10 days on unlimited amounts of milk, 50 days on limited amounts of milk, and a succeeding 30 days when no milk was fed. The average nutritive ratio to 100 days of age for all lots was 1:3.807.

**Swine type experiments,** S. BULL (*Natl. Stockman and Farmer*, 47 (1923), No. 15, p. 12, fig. 1).—In a feeding test at the Illinois Experiment Station, the rate and economy of gains of Poland China pigs of three different types (short-legged, long-legged, and medium) have been compared. There were 20 pigs in each lot but they were fed individually on a ration of corn, tankage, and middlings. The gains of the medium type were made 3.6 per cent more rapidly than the short-legged, and 15 per cent more rapidly than the long-legged type. The short-legged pigs required 3 per cent more feed and the rangy pigs 8 per cent more feed than the pigs of medium type.

Fifteen pigs from each lot were slaughtered at approximate weights of 225 lbs., and the carcasses were divided into the usual retail cuts and weighed. The amounts of lean, fat, and bone were then determined for each cut. The



dressing percentages were practically equal, but the carcasses of the long-legged pigs lacked quality, were not finished, and there was a greater percentage of bone and trimmings than in the carcasses of the other pigs.

The author states that if the long-legged pigs had been slaughtered at a heavier weight they would not have been so objectionable.

**Swine management**, G. L. BURLERSON (*La. Agr. Col. Ext. Circ. 62* (1922), pp. 34, figs. 2).—This consists essentially of a discussion of the general principles of care, management, feeding, and housing of swine, with brief articles on Grazing Crops for Hogs, by W. R. Perkins, and Hog Diseases, by M. M. La-Croix.

**A history of hogs and pork production in Missouri**, J. ASHTON (*Missouri State Bd. Agr. Mo. Bul.*, 20 (1923), No. 1, pp. 75, figs. 11).—A sketch of the history of hogs and pork production in Missouri is given, dating back to the time when Columbus brought the first hogs to Cuba and De Soto probably took hogs into Missouri in 1541. The very early history is given in considerable detail and includes many quotations from very old and almost inaccessible records.

**The duration of the gestation period in thoroughbred mares**, BÉDEL (*Rev. Zootech. [Paris]*, 2 (1923), No. 4, pp. 316-327, fig. 1).—Records of the length of gestation periods of 62 thoroughbred foals sired by two different stallions during the years 1920, 1921, and 1922 were studied as to the causes of the variation in length. It was found that males were carried in different years an average of from 4 to 10 days longer than the females. The foals of one stallion were carried longer than the foals of the other each year. There was also found to be considerable variation for different mares and under different conditions.

**Judging horses**, M. W. HARPER and E. S. HAM (*Cornell Reading Course for the Farm*, No. 162 (1923), pp. 40, figs. 22).—The essential principles of horse judging and descriptions of the breeds are briefly presented.

**Contribution to the knowledge of metabolism in birds**, Z. SOKOŁOWSKA (*Rocz. Nauk Rolnicz.*, 9 (1923), No. 2, pp. 211-234).—In experiments with fowls at the Jagellonian University, Krakow, Poland, it was found that the crude fiber of barley passed through the alimentary canal practically unchanged, whereas the greater part of the fiber of wheat bran and potatoes was digested. It was also found that nitrogen retention was much greater in animals receiving a mixture of potatoes and wheat bran than in animals receiving only barley.

In a second experiment 3 young fowls were fed for 5 days, after which 1 was killed and submitted to a complete analysis. The other 2 birds were fed for 28 days on liberal rations of barley alone for one bird and a mixture of potatoes and wheat bran for the other bird. The starch values of the two rations were equal. Both animals were analyzed at the end of the test, and it was found that both had formed considerable amounts of fat and that there also had been a marked increase in the amount of protein stored during the feeding period.

A French abstract of the article is appended.

**Poultry breeding records**, W. A. LIPPINCOTT (*Kansas Sta. Circ. 99* (1923), pp. 34, figs. 25).—This circular gives complete directions for keeping breeding records of poultry, discussing more especially the matings used and records of the progeny; trap nest records for egg production; and systems for storing eggs. Directions for pedigree hatching and marking the chicks by wing bands are also given, and sample pedigree blanks and record sheets are presented.

**Natural and artificial incubation of hens' eggs**, A. R. LEE (*U. S. Dept. Agr., Farmers' Bul. 1363* (1923), pp. II+18, figs. 5).—Revised edition of Farmers' Bulletin 585 (*E. S. R.*, 31, p. 173).



**Laying out a ten-acre poultry ranch**, G. R. SHOUP (*Western Washington Sta. Bimo. Bul.*, 11 (1923), No. 4, pp. 69-72, fig. 1).—Popular instructions for planning a small poultry farm.

**The poultryman's daily schedule**, MRS. G. R. SHOUP (*Western Washington Sta. Bimo. Bul.*, 11 (1923), No. 4, pp. 72-74).—A suggested daily working schedule for the practical poultryman.

### DAIRY FARMING—DAIRYING.

[**Experiments in the Minnesota Station**] division of dairy husbandry (*Minnesota Sta. Rpt.* 1922, pp. 65-67, figs. 2).—The experiments of this department have been mainly continuations of those previously noted (E. S. R., 47, p. 379).

**Food requirements for growing animals**, C. H. Eckles et al.—The additional data from 23 animals corroborate the results given in the previous report on the energy requirements of growing dairy animals. The feeding of yeast in addition to the regular rations to one-half of the purebred dairy calves until six months of age has shown no advantage in the form of additional growth. The results of the experiments in the use of milk as the sole diet for calves have been similar to those noted in the previous report.

**Raising calves with the minimum amount of milk**, Eckles and T. W. Gullickson.—Previously noted (E. S. R., 49, p. 473).

**Microorganisms in silage and their pathological significance**, Eckles, C. P. Fitch, and E. C. Stakman.—Moldy silage was fed to 3 sheep and 1 horse for 2 months, and large quantities of growing cultures of the common molds were administered as a drench to these animals with negative results. Four animals fed silage from 4 to 14 days which was supposed to have killed 6 cattle showed no detrimental effects from the feeding.

**Chemical and biological studies in animal nutrition** (*Minnesota Sta. Rpt.* 1922, pp. 37, 38).—Two studies with dairy cattle are reported under this project.

**Factors influencing the vitamin content of milk**, C. Kennedy, L. S. Palmer, and C. H. Eckles.—Essentially noted previously (E. S. R., 47, p. 78).

**Vitamin requirements for growth and milk production of dairy cattle**, Palmer, H. M. Harshaw, and Eckles.—A deficiency but not complete absence of vitamin B has been found in beet pulp, gluten feed, hominy, and rice. Autoclaving under 15 lbs. pressure would not reduce the slight growth-promoting powers of these feeds.

**"Silage corn" or "field corn" for silage?** C. C. HAYDEN (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 9-10, pp. 145-148).—The results of five years' tests in comparing the production and feeding value of silage from early maturing (Clarage) corn and late maturing (Blue Ridge) corn are reported. The average yields for the Blue Ridge per acre were 11.97 tons and for the Clarage 10.31 tons.

In studying the feeding value, from 8 to 12 cows were fed each year by the double reversal method, the same basal ration being fed to each lot according to appetite, the only difference in the rations being the kind of silage which was fed. In comparing the results, the author calculated that the Blue Ridge silage was 1.14 per cent more efficient for milk production and 2.17 per cent for butterfat production, whereas the Clarage silage seemed to be about 12.6 per cent more efficient in the production of gains in live weight. On an acre basis the Blue Ridge ration was about 6 per cent more efficient in the production of milk and 7 per cent more efficient in the production of butterfat.

[Sunflower v. corn silage for milk production], C. N. ARNETT (*Montana Sta. Rpt. 1922, p. 18*).—Six cows fed 91 days on corn silage produced an average of 23.19 lbs. of milk daily as compared with 22.56 lbs. of milk produced by other cows receiving a similar ration with sunflower silage substituted for the corn silage. Live weight gains were approximately equal in both lots.

Results of investigations on the herd of cows at the royal domain of Kleinhof-Tapiau, W. GRIMMER (*Landw. Jahrb., 58 (1923), No. 4, pp. 533-566*).—The author has summarized the data collected on the composition and production of milk in the Holstein herd at the royal domain of Kleinhof-Tapiau, Prussia, from October, 1887, to March, 1922 (period from July, 1914, to March, 1915, omitted). The data are treated in much the same manner as was first done by Fleischmann (*E. S. R., 3, p. 424*). The general conditions under which the data were collected were the same as noted in that paper. The cows were milked twice daily. They were usually pastured from the middle of May until the middle of October, and determinations of the amount, fat content, and specific gravity of the milk were made on three days of each week from which were calculated the total solids, solids-not-fat, and percentage of fat in the solids.

The averages for the daily records of all cows during each month of each year are tabulated in full and averaged for the years 1887 to 1914, which were not affected by the wartime conditions, and for the period 1918 and 1922 representing the post-war period. The following table gives the monthly averages for the two periods:

Average changes in milk production and composition of a Holstein herd during the different months of the years for the pre-war and post-war periods.

Month.	Average for the years 1887-1914.						Average for the years 1918-1922.					
	Average daily milk production.	Specific gravity.	Fat content.	Solids-not-fat.	Total solids.	Fat content of solids.	Average daily milk production.	Specific gravity.	Fat content.	Solids-not-fat.	Total solids.	Fat content of solids.
	Kg.	Degrees.	Per ct.	Per ct.	Per ct.	Per ct.	Kg.	Degrees.	Per ct.	Per ct.	Per ct.	Per ct.
January...	9.17	31.39	3.08	8.73	11.81	26.1	4.97	30.93	3.24	8.63	11.87	27.3
February...	9.94	31.30	3.01	8.69	11.70	25.7	4.93	31.05	3.14	8.65	11.79	26.7
March.....	10.71	31.19	3.03	8.67	11.70	25.9	5.38	31.18	3.02	8.66	11.68	25.8
April.....	11.08	31.01	2.97	8.61	11.58	25.7	5.59	30.50	3.03	8.49	11.52	26.3
May.....	10.79	30.68	3.16	8.57	11.73	26.9	6.74	31.29	3.11	8.71	11.82	26.3
June.....	11.23	30.85	3.16	8.61	11.77	26.9	9.49	31.91	3.18	8.88	12.06	26.4
July.....	9.68	30.35	3.29	8.51	11.80	27.9	8.65	31.59	3.20	8.80	12.00	26.7
August...	8.92	30.14	3.33	8.46	11.79	28.2	8.33	31.00	3.22	8.66	11.88	27.1
September	8.42	30.26	3.39	8.51	11.90	28.5	6.69	30.93	3.36	8.66	12.02	27.9
October...	7.77	30.52	3.34	8.56	11.90	28.1	5.58	30.79	3.50	8.66	12.16	28.8
November	7.87	31.08	3.13	8.66	11.79	26.6	4.94	31.15	3.38	8.73	12.11	27.9
December.	8.39	31.24	3.11	8.69	11.80	26.3	4.89	31.23	3.27	8.72	11.99	27.3

The author attributes most of the variations to the time of freshening of the cows and the changes from pasture to winter feeding. Most of the cows freshened in the late winter or early spring during the first period, but were somewhat variable in the second. The changes in composition and production of the milk following the placing of the cows on pasture are tabulated for each year. A study of the relationship between changes in composition of the milk throughout the year showed that the fat content was lowest when the milk flow during the stabling period was greatest. This usually occurred in the month of April, as most cows had just freshened at that time. The



fat percentage began to increase when the cows were put on pasture and continued to a maximum in the month of September.

The curves for total solids and fat percentage of the total solids are very similar to the curve for the fat content of the milk. The amount of solids-not-fat rises gradually from a minimum in August to a maximum in January, followed by a gradual decrease, though a slight increase occurs during the month of June. There is a tendency toward a reciprocal relationship between the content of fat and solids-not-fat. The specific gravity of the milk depends on the solids-not-fat and is closely related to it.

The relationship between the composition of morning and evening milk during each month from 1888 to 1896 is also tabulated in detail and discussed.

**The practicability of the milking machine,** J. L. LUSH (*Texas Sta. Circ.* 30 (1923), pp. 5-23, figs. 2).—Comparisons between hand milking and milking with machines followed by hand stripping have been made as to the yield, bacterial content of the milk, and time and cost of milking.

In studying the effect on yield, the cows of the herd were divided into two groups as evenly as possible, and group A was hand milked and group B milked with a machine during the first, fourth, fifth, and eighth 30-day periods. During the second, third, sixth, and seventh periods, group A was machine milked and group B hand milked. There was a natural decrease from one 30-day period to the next, due to advancing lactation, but the average decrease when the cows were milked with the machine in two continuous periods was  $16.4 \pm 1.57$  per cent, when milked by hand in two continuous periods  $13.6 \pm 2.03$  per cent, when milked by machine in one period and followed by hand in the second period  $13.4 \pm 1.12$  per cent, and when changed from hand milking in the first period to machine milking in the second  $17.3 \pm 1.96$  per cent. The slight differences in the rate of decreased yields are thus in favor of hand milking.

Comparisons of the bacterial counts of milk drawn by hand and by machine show that hand milking produced cleaner milk, but differences in the disinfecting solutions and methods of cleaning the udders produce far greater changes in the bacterial counts of the milk than differences between hand and machine milking. Records kept of the time required in milking by both methods showed that an average of  $7.296 \pm 0.035$  minutes were required for hand milking and  $4.643 \pm 0.016$  minutes for machine milking. It required, however, an additional 28.7 minutes each day for cleaning the milking machine. The estimated yearly expense for operating the milking machine was calculated at \$194.32.

**The effects of underfeeding on milk secretion,** A. C. RAGSDALE and C. W. TURNER (*Jour. Dairy Sci.*, 6 (1923), No. 4, pp. 251-260, figs. 2).—The effects of underfeeding on milk and fat production were studied at the Missouri Experiment Station by feeding a Jersey, a Holstein, and an Ayrshire cow in the first half of lactation for 3 days on a ration supplying more than an adequate amount of nutrients, followed by 10 days' feeding of a ration calculated to supply the exact requirements for nutrition, followed by a second 10 days' feeding on a ration supplying one-half the normal amount of nutrients, with a final 10-day period in which the animals were again placed on a super-normal plane of nutrition.

The amount of milk and the weights of the cows were reduced by decreasing the ration, but the fat percentage of the milk was increased. The average fat percentages for all cows in the four periods were, respectively, 4.059, 3.985, 4.453, and 3.728. The temperatures of the cows were also taken, but no consistent abnormalities were observed. This test was partially repeated with 8 cows, using shorter test periods, with similar results.



Cows first turned to pasture have shown decreased milk production and increased fat percentages due, it is suggested, to a lower plane of nutrition because of the large amounts of succulent grass required to supply sufficient nutrients for a normal plane of nutrition.

**Studies in milk secretion.**—XI, Relation between the butterfat percentage of one lactation and the butterfat percentage of a subsequent lactation in Guernsey advanced registry cattle, J. W. GOWEN (*Jour. Dairy Sci.*, 6 (1923), No. 4, pp. 330-346).—This is a more complete report of the paper previously noted from an abstract (E. S. R., 48, p. 478).

**Factors influencing two-day official butterfat tests of cows**, C. E. WYLIE (*Jour. Dairy Sci.*, 6 (1923), No. 4, pp. 292-298, figs. 3).—In studying the factors influencing the butterfat test of cows, the butterfat percentages of the milk of tested Jersey cattle have been found to vary during the different parts of the year, the lowest average test being 4.95 per cent in July and the highest 6.15 per cent in November. The fat test was also found to vary with the stage of lactation, the lowest fat percentages averaging 4.84 during the first month and gradually rising to 6.18 per cent in the twelfth month of lactation.

To study the variations in the fat content which might be induced by the owner, 22 Holstein and Jersey cows at the University of Tennessee were divided into two lots and the effect on the following 2-day fat percentage of leaving about one-fourth of the milk in the udder of one lot was determined for three different periods. Average increases of 0.08, 0.16, and 0.26 per cent were produced by leaving the milk in the udder. The application of the results of this test to 2-day official butterfat tests of cows is suggested.

**Copper in dairy products and its solution in milk under various conditions**, F. E. RICE and J. MISCALL (*Jour. Dairy Sci.*, 6 (1923), No. 4, pp. 261-277).—Nineteen experiments in determining the effects of different substances and conditions on the solubility of copper in milk are reported from the New York Cornell Experiment Station. The amount of copper dissolved has been found to be increased by the presence of air and oxygen in the milk, corroded surface of the copper, increased amounts of the surface of copper exposed, and time of exposure. A temperature of 145° F. seemed to be more favorable for dissolving the copper than higher or lower temperatures. Milk which had previously been boiled was found to dissolve much less copper than unboiled milk. An increased sugar or acidity content of the milk resulted in a very slight increase in the power to dissolve copper, whereas bubbling carbon dioxid through the milk had no effect. On separating milk containing large amounts of copper in a cream separator, it was concluded that the copper distributes itself between the cream and the skim milk fractions approximately in proportion to the amount of water present in each.

Several experiments indicated that copper may be lost from milk when it is placed in tin cans or when the milk is in contact with tin.

**Factors affecting the butterfat test of cream samples**, T. H. BROUGHTON and R. L. HAMMOND (*Indiana Sta. Bul.* 271 (1923), pp. 16, figs. 6).—The results of experiments are reported in determining the changes in the butterfat test of samples of cream held for varying periods under different conditions. Samples in sealed jars were not appreciably affected, but in the case of samples placed in open jars the fat test was increased at temperatures of 74, 90, and 135 to 140° F., with lower humidity, longer holding periods, richer cream, and wider mouthed jars. The changes in fat test ran as high as 8 per cent in 45 per cent cream held 48 hours at 90°, with the humidity 40 to 46 per cent. Other results of this test have been previously noted by Gregory (E. S. R., 48, p. 479).



**Better cream for butter making**, V. C. MANHART (*Indiana Sta. Circ. 113* (1923), pp. 12, figs. 7).—A popular discussion is given of the conditions that are necessary for the production of cream of the best quality. The off-flavors and undesirable characteristics which make cream undesirable for butter making are also discussed.

**Chemistry of the formation and manufacture of dairy products and factors influencing milk production and the composition and properties of milk** (*Minnesota Sta. Rpt. 1922*, pp. 39, 40, 42, 43, fig. 1).—A number of investigations have been made under this project, some of which have been previously noted (E. S. R., 48, p. 81; 49, p. 74).

*Factors influencing the viscosity of milk and their relation to creaming*, L. S. Palmer and E. O. Anderson.—This investigation has shown that a direct correlation exists between the depth of the cream layer on milk standardized for fat percentage and the viscosity of the milk and the factors influencing viscosity. As a factor in determining the volume of cream rising, the percentage of hydrophylic colloids in the milk is apparently of more importance than the size of the fat globules. The detrimental effect of pasteurization on creaming is apparently lessened by the presence of the fat globules, as cream will not rise when raw cream and skim milk previously pasteurized at 145° F. for 30 minutes are mixed. Albumin promotes a good cream layer, whereas casein depresses it. Pumping milk at 50° or lower also reduces the cream layer.

*Factors influencing the keeping qualities of whole-milk powders*, Palmer, C. D. Dahle, and H. Macy.—A continuation of this study (E. S. R., 49, p. 75) shows "that oxidative and hydrolytic decompositions and destruction of the peroxidase are accelerated by increasing the moisture content of the powders even though the moisture is still below the legal limit of 5 per cent." Room temperature offers the best storage condition for milk powders in temperate climates, but cold storage or tropical temperatures can be used when the powder is in sealed tin cans and does not contain large volumes of air in the powder granules. Paper containers are recommended for spray-process powders to be kept at room temperature, but they are not adaptable for drum-process powders where the fat on the surface of the granule tends to leak out and become stale.

*Factors influencing lactose crystallization in the occurrence of sandy ice cream*, Palmer and Dahle.—A study of sandiness in ice cream has been undertaken through a laboratory study of the crystallization of lactose in frozen solutions at 0° F. The solubility of lactose in water at 32° is about 10.5 per cent, but one may start with a 15 to 17 per cent solution and attain a solubility of from 12.5 to 13.5 per cent even after 14 days if kept at 0°. Protective colloids and acids were of no avail in delaying crystallization when used in quantities that might be added to ice cream. Sandiness is fundamentally a problem of crystal growth in ice. Low temperatures, 0°, delay crystal growth in contrast with temperatures of from 15 to 25°.

**Studies on the Streptococcus paracitrovorus group**, B. W. HAMMER and M. P. BAKER (*Iowa Sta. Research Bul. 81* (1923), pp. 17-36).—The results of a study of the characteristics of 124 cultures of *S. paracitrovorus* from milk, cream, and butter are reported, as well as 27 cultures of other similar organisms. *S. paracitrovorus* is apparently rather widely distributed in dairy products, and at least some cultures are resistant to pasteurization. The single method by which it may be differentiated with certainty from other related organisms is by its production of acidity in milk, a large portion of which consists of volatile acids. The amount of volatile acid produced in milk is also very greatly increased when sterile citric acid is added to the milk. By its



action the citric acid is also destroyed. *S. paracitrovorus*, as well as other closely related types, produce considerable CO<sub>2</sub>. More or less variation was observed between the different cultures of *S. paracitrovorus*, but no uniform basis was found on which to divide the group.

**Some factors influencing quality in gelatin and the use of the fermentation test as an index of bacterial contamination**, E. H. PARFITT (*Jour. Dairy Sci.*, 6 (1923), No. 4, pp. 278-282, figs. 2).—The quality of 15 samples of gelatin has been studied at the Indiana Experiment Station by means of the bacterial content, fermentation test, and jellying strength as determined by the percentage of gelatin required for jellying. Considerable variation was found in the different samples.

**The bacterial content of some Kansas ice cream**, A. C. FAY (*Jour. Dairy Sci.*, 6 (1923), No. 4, pp. 283-291).—The bacterial content of 115 samples of commercial ice cream entered in a judging contest during three years at the Kansas State Agricultural College varied from 1,500 to 47,000,000 per gram, with an average of 1,895,000. The author points out the value of the bacterial content of ice cream as an indication of the condition of the materials used and the care employed in the manufacture of the product. The effect of the different processes in manufacture on the bacterial content is discussed.

## VETERINARY MEDICINE.

**Technique and methods of bacteriology and serology**, M. KLIMMER (*Technik und Methodik der Bakteriologie und Serologie*. Berlin: Julius Springer, 1923, pp. XI+520, figs. 223).—In this reference book on bacteriological and serological methods for diagnosing infectious diseases, the subject matter is presented in three sections. The first or general section deals with German regulations concerning the control of communicable diseases, the collection and transportation of material for examination, and general directions for bacteriological laboratory work. The second or bacteriological section deals with general and special bacteriological and cultural work, including a chapter on various methods of immunizing animals. The final section on serological methods contains chapters on agglutination, precipitation, complement fixation, conglutination, hemagglutination, lipid fixation, and other serological tests, with their application to animal and human pathology. Extensive references to the original literature, mostly from German sources, are given as footnotes.

**A textbook of pathology**, F. DELAFIELD and T. M. PRUDDEN, rev. by F. C. WOOD (*New York: William Wood & Co.*, 1922, 12. ed., rev. and enl., pp. VI+1354, pls. 17, figs. 809).—The first part of this work is devoted to general pathology (pp. 3-509), the second part to special pathology (pp. 513-1184); and the third part to the method of making post-mortem examinations and the methods of preserving and examining pathological tissues (pp. 1185-1243). In the present revision many detailed textual changes have been made and new illustrations added, the bulk of which alterations are found in the chapters on tumors and the liver and in the portion devoted to the nervous system.

**Manual of veterinary medicine**, J. D. DUCHENE (*Min. Agr. Prov. Québec Bul.* 48 (1923), pp. 82, figs. 6).—This is an account intended for use by farmers.

**Livestock sanitation**, W. H. DALRYMPLE (*Baton Rouge: Gladney Press*, 1923, pp. 145, pls. 21).—This is a collection of short popular articles bearing upon the subject arranged under the headings of food, water, air and ventilation, soil, disposal of animal excreta, disinfection, a few important microbe and parasite diseases, observations concerning mistreatment of livestock, etc.



**Rhus dermatitis**, from *R. toxicodendron*, *radicans*, and *diversiloba* (poison ivy) : Its pathology and chemotherapy, J. B. McNAIR (*Chicago: Univ. Chicago Press*, 1923, pp. XI, 298, pls. 3, figs. 15).—This is a monographic account of poison ivy, its pathology and chemotherapy, based upon a review of the literature and investigations conducted. The bibliography covers 78 pages and is divided into classifications including botanical references, chemical references (fat formation—carbohydrates to fat in animals, carbohydrates to fat in plants, protein to fat in animals, Japan wax, chemistry of poisonous principle of *Rhus*, and laccase), pathological references, and remedies.

**White snakeroot** (*Eupatorium urticaefolium*) poisoning in livestock, L. P. DOYLE and F. L. WALKEY (*Indiana Sta. Bul.* 270 (1923), pp. 15, figs. 11).—An introductory account of the relation of white snakeroot to livestock poisoning is first presented, which includes a description of the plant and an account of the present importance of such poisoning. Feeding experiments with the green plant carried on with cattle, horses, chickens, pigs, and rabbits, including a report of post-mortem findings in the animals poisoned, is presented, followed by a report of similar experiments with the dried plant.

It is pointed out that in certain regions, especially where pastures are wooded, white snakeroot is still a dangerous plant capable of causing serious losses in livestock. A survey made by A. A. Hansen, of the department of botany, has shown the plant to be widely distributed throughout the State. Although it is generally believed that livestock do not eat white snakeroot unless there is a shortage of other pasture, a serious outbreak of poisoning from it was observed to occur in cattle in a partly wooded pasture where there was an abundance of grass in the unwooded part. It is thought possible that the cattle formed the habit of browsing the snakeroot in the wood while seeking shelter from the sun.

The toxicity of the green plant was amply demonstrated in the feeding experiments, and the results obtained from feeding the dried plant indicate that if it were to be incorporated in hay the dry forage might cause poisoning in livestock. Trembling in the affected animals was not found to be nearly as conspicuous a symptom in horses as in cattle. The susceptibility of chickens to snakeroot poisoning and the ease with which they may be given definitely weighed amounts of the various parts of the plant suggest that they may be very useful in the investigation of poisonous plants.

[Report of the Minnesota Station] division of veterinary medicine, C. P. FITCH ET AL. (*Minnesota Sta. Rpt.* 1922, pp. 107-114).—In this report the authors consider, in addition to projects noted below, the progress of work with obscure diseases, infectious white scours and calf pneumonia, distribution of antihog-cholera serum and virus, and the application of the benzoate renal function test to cattle.

In studies of artificial immunity in bovine infectious abortion, by Fitch, W. L. Boyd, and W. A. Billings, it has been found that natural infection does not offer a reliable means for testing the immunizing value of biological agents. The authors confirm the results obtained by Little (*E. S. R.*, 48, p. 86), showing that ingestion of colostrum quickly affects the antibodies present in the blood of the calf.

"A rapid method for the cultivation of *Bacterium abortus* Bang has been perfected. Briefly, it consists of the use of horse serum agar culture media, using 10 per cent naturally sterile horse serum. The media are adjusted to a pH of approximately 7 to 7.2. This is slightly more alkaline than has been recommended before. We have been able to show also that carbon dioxid has no specific effect on the growth of this organism. Cultures made on the above

mentioned media and incubated in an atmosphere of 10 per cent CO<sub>2</sub> or H<sub>2</sub> will show colonies at the end of 24 hours and reach a maximum growth at 72 hours."

In studies of the pathology of sterility resulting from the disease, by Boyd, Fitch, and D. C. Beaver, it has been quite satisfactorily demonstrated that the retained corpus luteum will not only interfere with ovulation but will also in cases of pyometritis influence the muscle tone of the uterus. *Bacillus coli communior* was isolated by Fitch, Boyd, and Billings from a foal that died 36 hours after birth, and streptococci were isolated from cases of strangles among university farm horses showing little variation from the streptococci isolated from cases of navel ill.

H. C. H. Kernkamp reports that in nearly every instance where swine carcasses were carefully examined at the time of slaughter, at least one characteristic lesion of hog cholera and in many cases more have been found. Most of these pigs had been immunized from 5 to 7 months previous, when they weighed about 40 lbs. Studies by the same author of serum-virus treated swine as carriers of hog cholera virus show that susceptible pigs will contract hog cholera if placed with serum-virus treated swine between 14 and 21 days after treatment. The virulent bodies are eliminated in the body excretions (feces and urine). None of the pigs exposed after 21 days from date of treatment contracted the disease. Investigations were made by Kernkamp of the nature of a disease characterized by a paralysis of the hind parts, which indicate that it is of trophic origin and is the result of a mineral deficiency. The comparative percentage weights of viscera of normal swine was determined by Kernkamp.

A study by E. A. Hewitt of the correlation of body temperature in different parts of the body, the axilla, abdomen, and rectum, was made in small animals, showing from 0.1 to 0.2° difference, but in general a close parallelism.

[Report of the Montana Station] department of veterinary science, H. WELCH (*Montana Sta. Rpt. 1922, pp. 26, 27*).—Progressive pneumonia in sheep, commonly known as "lunger disease," is said to be without doubt more prevalent among flocks in the State than heretofore and has a wider distribution. No progress was made toward its control. It was definitely established, however, that under ordinary range management no lunger sheep ever recover or even improve in condition, that "lungers" in the ewe band in the fall will not live through to lambing time, and that those with lunger disease in the spring, if sent to summer range, will die before fall.

Dipping in the fall has proved the best preventive for lice on cattle when on winter feed. For cattle that can be handled, a mixture of kerosene and linseed oil in the proportion of 2 to 3, applied with a brush where the lice congregate and thoroughly rubbed in, has been found effective.

Report of proceedings under the diseases of animals acts, with returns of the exports and imports of animals for the year 1921, D. S. PRENTICE (*Ireland Dept. Agr. and Tech. Instr., Rpt. Diseases Anim., 1921, pp. 46*).—This, the usual annual report (E. S. R., 49, p. 278), includes a discussion of foot-and-mouth disease in Great Britain and statistical tables giving data on the occurrence of hog cholera, anthrax, glanders, parasitic mange, sheep scab, foot-and-mouth disease, bovine tuberculosis, etc.

Annual report on the occurrence of infectious diseases of animals in Germany (*Jahresber. Verbr. Tierseuch. Deut. Rëiche, 31 (1919), pp. IV+31*).—The usual annual report (E. S. R., 48, p. 480), covering the year 1919.

Anthrax vaccination and serum therapy in the District of Bouira (Algeria), P. ROSSI (*Arch. Insts. Pasteur Afrique Nord, 3 (1923), No. 2, pp. 177-188*).—A brief account is given of the author's experience in the vaccination



and serum therapy of cattle and horses during the course of two outbreaks of anthrax occurring in August and December, 1922.

Of 17 cattle treated with antianthrax serum during the course of the disease, 11 were cured and 6 died, showing that in certain cases the serum strengthens the natural resistance, while in others it appears to hasten the course of the disease. From observations of these cases the indications for the treatment with serum are considered to be high temperature and satisfactory heart action. If the temperature is subnormal and the heart action poor, it is considered useless to inject the serum. A single dose of at least 150 cc. is preferred to repeated doses in smaller amounts. In the case of horses and mules the dose should be at least 200 cc.

As a preventive measure the injection of 30 cc. of antianthrax serum is recommended for cattle which have already been exposed and 20 cc. for those not exposed. Of 55 cattle injected as a precautionary method with 20 cc. of vaccine, 5 contracted anthrax subsequently, while of 71 horses or mules injected with 20 or 25 cc., 3 contracted the disease. A dose of from 40 to 50 cc. is recommended for horses.

Among 500 cattle treated with serum, 2 cases of serum sickness and 1 of anaphylaxis were noted, indicating that accidents due to the injection of serum are of only slight importance.

**The nomenclature of the melitensis-abortus group of bacterial organisms,** A. C. EVANS (*Pub. Health Rpts. [U. S.], 38 (1923), No. 34, pp. 1943-1948*).—The author discusses briefly the various names which have been applied to the group of microorganisms causing Malta fever and contagious abortion, and suggests as the most logical classification the adoption of the term *Brucella melitensis* to represent the type species of the genus *Brucella*. This is described as follows: "Minute rods with many coccoid cells (the cells of 2-day cultures grown on the surface of plain agar and stained with carbol fuchsin appear about 0.5 of a micron wide and 0.5 to 2 microns long); not forming endospores; nonmotile; aerobic, or preferring a slightly reduced, partial pressure of oxygen; without gelatin liquefaction; Gram-negative; parasitic, invading animal tissues; neither gas nor acid production from the carbohydrates." The varieties causing abortion and Malta fever would thus be named *B. melitensis abortus* and *B. melitensis melitensis*, respectively.

**The serological classification of *Brucella melitensis* from human, bovine, caprine, porcine, and equine sources,** A. C. EVANS (*Pub. Health Rpts. [U. S.], 38 (1923), No. 34, pp. 1948-1963, fig. 1*).—This paper contains a review of the literature on the relationship between the causative organisms for contagious abortion and Malta fever, a description of the technique employed by the author in the serological study of these organisms, and the report of the results of the application of this technique to the classification of 49 strains from human, bovine, porcine, equine, and caprine sources. The classification of the strains was made according to the following principle:

"Any strain which absorbs agglutinin from the test serum to the same degree as the homologous strain belongs to the same serological group. A strain which absorbs agglutinin from the test serum to a degree slightly different from the homologous strain may or may not belong to the same serological group, but a marked difference in absorbing capacity indicates a difference in serological grouping. Equal absorbing capacities of two strains from a heterologous serum does not signify that the two strains belong to the same group. Every strain belonging to the same group as the strain used in the preparation of a given serum will completely absorb the agglutinin from the 1:5 dilution of that serum as used in these tests if an absorbing antigen of sufficient density is used, and, vice versa, every strain belonging



to another serological group will fail to completely absorb the agglutinin from a given serum under the same conditions."

According to this classification, the strains examined could be differentiated into at least 7 serological groups, of which 4 contained only 1 or 2 strains each and were considered relatively unimportant. The majority of the bovine and porcine strains (30) and 2 of human origin fell into one group which is designated variety *abortus*. A second group of 11 strains included strains of human, bovine, caprine, and equine origin and is designated variety *melitensis* A. A third group of 3 strains was characterized by a predominance of coccoid cells and is designated variety *melitensis* B.

"Simple agglutination tests can not differentiate between varieties *abortus* and *melitensis* A. These two varieties can be differentiated from *melitensis* B by the simple agglutination test only when the titer of the serum used is accurately known for the several varieties."

**Studies on bacterial nutrition.—IV, Effect of plant tissue upon the growth of pneumococcus and streptococcus,** H. J. MORGAN and O. T. AVERY (*Jour. Expt. Med.*, 38 (1923), No. 2, pp. 207-217, figs. 3).—In this continuation of the series of studies previously noted (E. S. R., 46, p. 78) observations are reported on the effect upon the growth of pneumococcus, *Streptococcus hemolyticus*, and *S. viridans* of unheated potato tissue and other plant tissues which have been shown to have growth-promoting properties for *Bacillus influenzae* (E. S. R., 46, p. 866).

The presence of unheated tissue caused immediate and rapid growth, prolonged the period of growth, and delayed the death of the organisms tested. It extended the zone of H-ion concentration within which growth in ordinary broth culture could be initiated.

**The action of Bayer 205 on mice experimentally infected with Trypanosoma equinum and T. pecaui,** E. BRUMPT and G. LAVIER (*Ann. Parasitol. Humaine et Compar.*, 1 (1923), No. 3, pp. 247-251).—Experiments here reported demonstrate the protective and curative value of Bayer 205.

**What are we to do for the repression and eradication of tuberculosis in cattle?** B. BANG (*Jour. Compar. Path. and Ther.*, 36 (1923), No. 3, pp. 156-170).—This is a discussion of the subject based upon the author's experience in Denmark.

**The bull as a carrier of contagious abortion,** J. W. KALKUS (*Western Washington Sta. Bimo. Bul.*, 11 (1923), No. 4, pp. 66).—The author calls attention to the fact that carefully conducted experiments at several experiment stations in the past few years indicate that the bull is a very small factor in the transmission of contagious abortion through the act of breeding. The great bulk of experimental evidence indicates that a cow becomes infected almost invariably through the digestive system, by ingestion. It is pointed out, however, that the sire should be kept separated from the herd and have a separate pen to be used for breeding purposes only.

**An infectious ophthalmia of cattle,** F. S. JONES and R. B. LITTLE (*Jour. Expt. Med.*, 38 (1923), No. 2, pp. 139-148, pl. 1).—This is a report of studies by the department of animal pathology of the Rockefeller Institute for Medical Research at Princeton, N. J., in which 24 cases of an acute ophthalmia of cattle have been observed.

"The infection is characterized by photophobia, severe congestion of the vessels of the eyeball, conjunctivitis, congestion and edema of the membrana nictitans, edema of the eyelids, accompanied by a thick, yellowish white mucus or mucopurulent exudate. In certain cases corneal ulcers and extensive corneal opacities developed. From all cases a characteristic diplobacillus was obtained. The organism was usually observed in the exudate in large numbers.



The morphology, the hemolytic properties, and the proteolytic activities readily assist in its identification. Instillation of a few drops of bouillon suspensions of pure cultures beneath the eyelids of normal cattle gave rise to characteristic inflammations. The organism is not pathogenic for laboratory animals."

**Osteomalacia and its occurrences in cattle in Norway**, P. TUFF (*Jour. Compar. Path. and Ther.*, 36 (1923), No. 3, pp. 143-155, fig. 1).—Osteomalacia in cattle occurs frequently and is of considerable economic importance in Norway. Insufficient supply of minerals through the fodder is the most frequent cause and is most often due to (1) the insufficient quantities of lime and phosphoric acid in the soil (osteomalacious districts), and (2) to the fact that the plants resorb too little mineral salt owing to heavy drought during the period of growth. After a heavy drought bone brittleness frequently appears.

"An essential displacement of the natural mutual quantitative proportion between the inorganic salts in the fodder will predispose to osteomalacia. Various symptoms accompanying osteomalacia can be explained as a weakened function of the various organs because of loss of calcium and phosphoric acid. Treatment must be adjusted according to causes. Generally after a heavy drought there is insufficient phosphoric acid, and then the use of phosphas natricus is favorable. In the use of hay from marshes and forest both phosphoric acid and calcium are generally lacking. In that case phosphate of calcium, bone meal, or fish meal, should be used.

"Preventive treatment is, however, the most important. Systematic investigations should therefore be undertaken to decide the causes of osteomalacious districts. Such investigations should include inter alia a quantitative analysis of the inorganic salts in the soil and vegetation, and also a botanical survey of the chief plants. Pastures which have been observed to cause osteomalacia should be manured with the mineral substances lacking. More especially, measures should be taken in districts where experience has taught that osteomalacia follows periods of drought. In indoor feeding care should be taken when mixing the fodder that it contains sufficient lime and phosphoric acid in the correct mutual proportions. Cows which produce much milk should always receive additional lime and phosphoric acid. They should also have a period of barrenness sufficiently long for them to store up the necessary quantity of mineral substances."

**The more important poultry diseases**, L. VAN ES and H. M. MARTIN (*Nebraska Sta. Bul.* 195 (1923), pp. 5-71, figs. 14).—This summary of information deals with the subject under the headings of cure or prevention (p. 6), poultry hygiene (pp. 6-12), microbic diseases (pp. 13-52), parasitic diseases and parasites (pp. 53-69), and deficiency diseases (69-71).

**Colds and roup**, W. T. JOHNSON (*Western Washington Sta. Bimo. Bul.*, 11 (1923), No. 4, pp. 74-77, figs. 3).—This is a summary of practical information on these diseases of poultry.

**The organisms of the fowl typhoid group**, R. ST. JOHN-BROOKS and M. RHODES (*Jour. Path. and Bact.*, 26 (1923), No. 4, pp. 433-439).—A brief report is given of cultural and serological studies of a number of colon-typhoid microorganisms causing infection in birds. The material examined included a collection of so-called hemorrhagic septicemia organisms, a series of freshly isolated strains from cases of bacillary diarrhea, and strains of *Bacterium pullorum* A and B. *Bacillus rettgeri*, *B. jeffersoni* and *B. Pfaffi* obtained from the Rhode Island Experiment Station. The conclusions drawn from this examination are as follows:

"*B. gallinarum* Klein and *B. sanguinarium* Moore appear to be one and the same organism. The division of *Bacterium pullorum* Rettger into two groups—A and B—appears to be very artificial and without significance with regard



to selective infectivity of young and adult stock. Strains of *Bacillus gallinarium* can produce lesions in young chicks indistinguishable from those associated with bacillary white diarrhea. The organism described by Hadley as *B. jeffersoni* n. sp., is merely a rough variant of *B. gallinarum*. Pfaff's canary-bird organism is a member of a group of bacteria presenting cultural and serological reactions quite distinct from the *B. gallinarum-pullorum* group and from the true *Salmonellas*. They are also readily distinguished from *B. avisepticus* and other organisms of the hemorrhagic septicemia group."

## RURAL ENGINEERING.

**Irrigation district operation and finance**, W. A. HUTCHINS (*U. S. Dept. Agr. Bul. 1177* (1923), pp. 56, figs. 5).—This bulletin outlines the history and explains the purpose and methods of operation of irrigation districts, with particular reference to the legal and financial features involved.

**Surface water supply of lower Mississippi River Basin, 1921** (*U. S. Geol. Survey, Water-Supply Paper 527* (1923), pp. III+39, pls. 2).—This report, prepared in cooperation with the States of Colorado, Missouri, and Kansas, presents the results of measurements of flow made on streams in the lower Mississippi River Basin during the year ended September 30, 1921.

**Proposed loading for highway bridges**, H. D. HUSSEY (*Amer. Soc. Civ. Engin. Proc.*, 49 (1923), No. 6, pp. 1031-1037, figs. 4).—A discussion is given of highway bridge loads together with a proposed new loading system for use in highway bridge design. The study demonstrated that the ordinary uniform loading system is unsatisfactory for modern bridges. It was evident that in order to obtain the most uniform results the actual wheel loads of the trucks themselves should be used in the loading system. A system of loads in which the truck concentrations are followed by a uniform load was found to be the most satisfactory form.

**Concrete products: Their manufacture and use**, W. R. HARRIS and H. C. CAMPBELL (*Chicago: Internatl. Trade Press, Inc.*, 1921, pp. XVIII+238, figs. 89).—Practical information on the manufacture and use of common concrete products is presented in this book. It contains chapters on concrete products as a business; selling concrete products; specifications for building units; materials used in the manufacture of products; concrete products; types of block machines and block; concrete chimney block; standard block and tile sizes; cement mortar colors; hollow building tile; concrete brick; concrete roofing tile; cement asbestos shingles; concrete architectural trimstone; sills, lintels, and other trimstone; ornamental concrete products; plaster and glue molds; working details of form construction for concrete drinking fountain; forms and molds for some special products; surface finish of concrete products; concrete light standards, fence posts, silo staves, stave construction, culvert pipe, sewer pipe, drain-tile, pressure pipe, irrigation pipe, burial vaults, and railroad ties; curing concrete products; concrete products plant layout and equipment; tests on concrete products; colleges and commercial laboratories equipped for testing concrete products; machinery and molds; and exhibiting concrete products.

**Effect of repeated loads on concrete slabs**, R. B. CREPPS (*Engin. and Contract., Roads and Streets*, 60 (1923), No. 2, pp. 209-212, figs. 5).—Investigations of the fatigue element with respect to cement mortar, conducted by the Purdue University in cooperation with the U. S. Department of Agriculture, are reported. The original specimens were 30 in. long and 4 by 4 in. in cross section, and a 1:2 mixture was used.

The results of the 28-day tests with 12 beams indicated that no definite endurance limit between 40 and 60 per cent of that load required to break the



beam under a single application can be assigned to cement mortar of this age. The results of the 4-month tests of 8 beams indicated that the endurance limit is approximately from 50 to 55 per cent of the static load. The 6-month tests with 6 beams showed that the endurance limit is from 54 to 55 per cent of the static breaking load.

The number of reversals of stress necessary to cause failure decreased in proportion to the respective increase of the percentage of stress above the apparent endurance limit. Stresses above the endurance limit caused continual progressive deformation. Stresses below the endurance limit may cause progressive deformation within certain limits.

The effect of a rest period indicated that the rate and number of intermittent applications of load ranging in intensity above the endurance limit would have considerable bearing upon the life of a concrete structure. The amount of recovery in strength in the case of cement mortar was found to be directly proportional to the duration of the period of rest. Above the premature failure limit no appreciable recovery occurred.

**The disintegration of cement in sea water**, W. G. ATWOOD and A. A. JOHNSON (*Amer. Soc. Civ. Engin. Proc.*, 49 (1923), No. 6, pp. 1038-1064, figs. 2).—This is a brief history of the study of cement for use in sea water and an analysis of the results obtained.

It is noted that practically all skilled experimenters with hydraulic binding agents for the last 100 years have agreed that the primary cause for the disintegration of mortar and concrete in sulphate-carrying waters, such as sea water and many alkali waters, is the attack on the free lime in the mortar by the sulphates in the water. The majority of the authorities agree that this disintegration can be prevented by the addition to standard Portland cement of a properly constituted siliceous material, which, by combination with the free lime released in the process of setting, will form a cementing material insoluble in sulphate-bearing water. The high alumina cements attain the same results by different means which appear to be just as effective, but thus far the cost of the high alumina cement seems to be greater than that of Portland cement. On the other hand, it is thought that the addition of silica to Portland cement should result in a cheaper product.

**Better concrete on the farm**, J. C. WOOLEY (*Missouri Agr. Col. Ext. Circ.* 124 (1923), pp. 14, figs. 12).—Practical information on the mixing and use of concrete on the farm is presented.

**Basic grading rules and working stresses for structural timbers, as recommended by the Department of Agriculture**, J. A. NEWLIN and R. P. A. JOHNSON (*U. S. Dept. Agr., Dept. Circ.* 295 (1923), pp. 23, figs. 2).—Basic grading rules and working stresses for structural timber resulting from a long series of tests in the Forest Products Laboratory are presented.

**Standard grading specifications for yard lumber, as recommended by the Department of Agriculture**, E. P. IVORY, D. G. WHITE, and A. T. UPSON (*U. S. Dept. Agr., Dept. Circ.* 296 (1923), pp. 75, pls. 23, figs. 2).—This discusses the development of specifications for yard lumber and, on the basis of four years' study by the Forest Products Laboratory, recommends standard grading specifications for yard lumber.

**Spark advance in internal-combustion engines**, G. B. UPTON (*Jour. Soc. Automotive Engin.*, 13 (1923), No. 2, pp. 111-121, 172-174, figs. 21).—In a contribution from Cornell University a review is given of literature relating to the influence of the proper timing of the ignition on the proper functioning of internal-combustion engines.



This is followed by an analysis of data which indicates that spark advance is a relation of the explosion time to the speed of rotation of the engine. It is shown that the relation between the progress of the explosion and the motion of the engine piston should be such that half the rise of pressure during combustion will occur at the dead center position of the piston. Both theoretical and experimental analyses, however, indicate that one-half of the pressure rise occurs substantially at three-fourths of the explosion time. This is taken as the numerical basis for the relations of explosion time, engine speed, and optimum spark advance.

The existing data relating to the explosion time as affected by the mixture ratio, the size of the combustion chamber, turbulence, dilution with dead or exhaust gases, and the temperatures preceding the explosion are reviewed. It is shown that density does not affect the explosion time. The factor commonly supposed to be density, which demands an increased spark advance as the engine is throttled, is in reality dilution with exhaust gas, which increases as the throttle closes, and the cause of the faster explosion in a high-compression engine than in one of low compression is the temperature preceding ignition.

**A simple mathematical law connecting the explosion rate and turbulence and derived from experiments on bombs is shown to be applicable to engines, and the manner of its application to the turbulence factor of any engine is indicated.**

The slowing up of combustion on account of the dilution of the charge with exhaust gas was measured experimentally, and the results are compared with the numerical extent of the dilution. Assuming that the dilution ratio is the ratio of the total charge to the quantity of new gas, the slowing up of combustion because of dilution is shown to be about proportional to the cube of the mass dilution ratio.

By measuring the optimum spark advance, the combustion rates of gasoline with and without anti-knock or tetraethyl lead were measured. Although the quantity used was 20 times the normal amount, no change in the reaction rate of combustion was found when the combustion remained normal. When detonation occurred without anti-knock the reaction times with anti-knock followed those to be expected with normal combustion. Detonation apparently changed the combustion habit as if it produced an abnormal top to the combustion.

**Effect of compression on detonation and detonation control, H. L. HORN-ING (*Jour. Soc. Automotive Engin.*, 13 (1923), No. 2, pp. 144-150, pgs. 6).—**The author considers the detonation tendency of fuel as the limiting factor in the development of power and the efficiency with which the fuel can be burned, with the idea of laying down the principles upon which better economy can be attained through higher compression. The causes of detonation are enumerated, and the methods of control are explained, consideration being also given to hot spots, cooling difficulties, and turbulence as controlling factors. A statement is made of the actual compression pressures attained without detonation in road tests.

**The effect of speed on mixture requirements and other carburetion requirements, C. S. KEGERREIS and G. A. YOUNG (*Purdue Univ., Engin. Expt. Sta. Bul. 11* (1923), pp. 31, figs. 16).—**In this publication data are presented, the purpose of which is to establish definitely the mixture ratios required by automotive engines as affected more especially by speed. The results of this investigation are considered to supplement those of a previous study (*E. S. R.*, 44, p. 484).



The results showed that at any given engine load a constant mixture ratio is required at all speeds for maximum power and maximum efficiency at that load. Idling loads at all speeds necessitated richer mixture ratios for both power and efficiency than the higher loads. The mixture requirements were not appreciably affected by the kind of automotive engine if the temperature for carburetion was adequate, the distribution uniform, and the compression ratio the same. There was a definite relationship between engine load and mixture ratios required for maximum efficiency. Dry mixtures were not absolutely necessary for good performance, but a dry mixture allowed leaner fuel-air ratios than could be utilized when operating with wet or heavy fog conditions.

It is concluded that the ideal carbureter must recognize engine load as well as air flow, and that mixtures must be enriched for acceleration when changing to a different speed or load for economical operation. Operation under throttled conditions, excepting with very low loads, allowed lean ratios to be utilized, thus maintaining high economy. It was found that when full load operation requires maximum power to be delivered the mixture strength must be enriched.

These results in general are taken to indicate that the change of speed of automotive engines does not affect the mixture ratios required to any marked degree when the temperatures are high enough for good carburetion and the compression ratio is the same.

**Motor transportation of merchandise and passengers**, P. WHITE (*New York and London: McGraw-Hill Book Co., Inc., 1923, pp. VII+486, figs. 76*).—This volume considers motor transportation as a rapidly developing business activity, and treats merchandise and passenger transportation by motor vehicle in relation to each other and in relation to other methods of transportation. One of its chapters deals with the motor truck on the farm.

**Report on the tractor trials held at Shrawardine**, G. W. WATSON ET AL. ([*London*]: *Soc. of Motor Manfrs. & Traders, 1921, pp. 99, pls. 2, figs. 51*).—The results of these tractor tests, conducted in England in 1921, are presented in graphic and tabular form and briefly discussed. No basic conclusions of a general nature are drawn.

**The tendency of tractors to rise in front; causes and remedies**, A. H. HOFFMAN (*California Sta. Circ. 267 (1923), pp. 8, figs. 9*).—The tendency of tractors to rise in front is briefly analyzed, and remedies therefor are suggested. Defective design and careless or inefficient operation are apparently the main causes, and loading of the front wheels with cast iron or concrete is proposed as one of the most effective practical remedies.

**Farm implements and machinery**, J. R. BOND (*London: Benn Bros., Ltd., 1923, pp. XVI+282, figs. 273*).—This book contains a foreword by E. J. Russell, and presents practical information on the uses and operations of farm implements and machines, their proper selection, adjustment, and care. It includes chapters on tillage, the work of the plow, types and varieties of plow, setting and operating the plow, cultivators, harrows, rollers, manure distributors, seed-sowing machines, implements for after cultivation, harvesting machinery (the hay crop, corn, and potatoes), elementary mechanical principles, the horse as a motor, heat engines, mechanical cultivation (steam tackle), tractors, tractor plows and plowing, barn machinery (transmission, corn mills, chaff cutters, and pulpers), and threshing machines and sheep shearers.

**Belt conveyors and belt elevators**, F. V. HETZEL (*New York: John Wiley & Sons, Inc., London: Chapman & Hall, Ltd., 1922, pp. XI+333, figs. 291*).—This is a practical treatise the main purpose of which is to explain fundamental



principles and the reasons for doing things. Section 1 deals with belt conveyors and section 2 with belt elevators.

**Sewing grain sacks**, J. KOEBER (*California Sta. Circ.* 261 (1923), pp. 11, figs. 15).—Practical information on the sewing of filled grain sacks is presented.

**Dairy barn construction**, K. E. PARKS (*U. S. Dept. Agr., Farmers' Bul.* 1342 (1923), pp. II+22, figs. 17).—This discusses the principal features of modern dairy barn construction and equipment, and presents practical plans for various types and sizes of dairy barns.

**Beef-cattle barns**, E. W. SHEETS and M. A. R. KELLEY (*U. S. Dept. Agr., Farmers' Bul.* 1350 (1923), pp. II+17, figs. 16).—Practical information on the planning, construction, and equipping of beef-cattle barns is presented.

**Privies and sewage disposal plants for isolated dwellings** (*Pub. Health News* [N. J.], 8 (1923), No. 3-4, pp. 322-339, figs. 11).—Practical information, tabular data, and detailed drawings for sanitary privies and small sewage disposal plants for isolated dwellings, as found efficient under New Jersey conditions, are presented in this report.

**Activated sludge studies, 1920-1922**, A. M. BUSWELL ET AL. (*Ill. State Water Survey Bul.* 18 (1923), pp. 150, figs. 31).—This report describes the sewage experiment station of the Illinois Water Survey and the methods of conducting the activated sludge studies, and reports the results of recent work on the biochemistry of the activated sludge process and on the microbiology and theory of activated sludge. The results of sludge drying experiments are also presented.

## RURAL ECONOMICS AND SOCIOLOGY.

**A farm management study of the Great Salt Lake Valley**, G. STEWART (*Utah Sta. Bul.* 184 (1923), pp. 3-44, figs. 13).—A survey of 428 farms in central Salt Lake County, central Davis County, and northwestern Weber County, Utah, was made in 1915 by the station and the U. S. Department of Agriculture, cooperating. The work of preparing the data for publication, practically completed by E. O. Wooton but discontinued because of the changed conditions due to the World War, was subsequently resumed in the belief that these records, representing, as they do, the farming business for 1914, are more typical of conditions in 1922 than are those of any year since that time.

Most of the farms included in the survey were irrigated general farms, with here and there some dry farming in addition. Truck farming areas were avoided. The farms as a whole averaged 75.6 acres in size, of which 63.6 acres were tillable. There was an average of 43.1 acres in crops, 46.1 acres being devoted to field crops and the remainder to orchard and home garden. On the average, there were 16 acres of tillable pasture and 4.6 acres in fallow. The farms were grouped according to five types including diversified, beets, stock, grain and hay, and specialized farms with three combination groups, dairy and beets, dairy, and dairy, grain, and hay. Of these the diversified, the beet, and the dairy farms were on the average most profitable, with the farms combining dairy and beets or dairy, grain, and hay being from 30 to 50 per cent more profitable than the best group where there was no such combination. As a group, the farms below 50 acres in size were not profitable, the larger the farm the greater being the profit when averages are considered.

Only a few farms kept many livestock, there being but an average of 14.9 animal units and 4.3 dairy cows to each farm. Livestock farms and dairy farms, however, maintained on the average 25.4 and 25.6 animal units, respectively, and the dairy-grain-and-hay farms 28.3 animal units. A few large



farms were well stocked, the 15 farms of 200 acres or over averaging 51.9 animal units.

An examination of the data seems to indicate that if an increase in the size of the small farms to at least 50 acres could be made without too violent readjustments it might assist in bringing larger returns. The keeping of a few good dairy cows on more of the farms in order to utilize cheap feed and labor not otherwise employed in winter appears to be an incompletely developed source of income. On many of the farms, keeping more hogs than poultry and adding a few sheep might increase the farm income, and better home gardens and orchards are recommended.

The land in the area as a whole is so high-priced that the average farmer could with difficulty buy a farm and pay for it from the proceeds unless about half of the price of the farm could be paid at the time of purchase. Farmers who had attended only district schools made an average labor income of \$397 as compared with \$427 for those who had attended high school and \$813 for those who had attended college.

[**Farm management investigations in Montana in 1922**], E. L. CURRIER (*Montana Sta. Rpt. 1922, pp. 22, 23*).—Conclusions reached after a preliminary survey of three dairy sections of the State and from studies in northern Montana begun in 1921 are briefly stated.

**Cost accounting investigations on Minnesota farms**, G. A. POND ET AL. (*Minnesota Sta. Rpt. 1922, pp. 56, 57*).—Preliminary reports are presented which have been compiled from a second year's survey in the 5-year project previously noted (*E. S. R.*, 47, p. 392). The average receipts per farm on 23 farms in Cottonwood and Jackson Counties, Minn., for the year ended February 28, 1922, were \$2,138, expenses \$1,255, the decrease in inventory \$288, and the farm income \$595. The average receipts on 23 farms in Steele County for the year ended December 31, 1921, were \$2,947, and the average expenses \$1,614. There was a decrease of inventory of \$1,226, leaving a farm income of \$107. The average value of farm products used in the household was \$184.30 in Steele County, and \$230.08 in Cottonwood and Jackson Counties.

**Report to the Board of Agriculture for Scotland on the financial results on 65 farms for the period Martinmas, 1919, to Whitsunday, 1921, and on the cost of production of 1920 crops and of milk**, J. WYLLIE (*Edinburgh: Bd. Agr. Scot., 1922, pp. 30*).—This is the complete report of investigations initiated by the agricultural costings committee set up jointly by the Ministry of Food and the departments of agriculture for Great Britain and Ireland in November, 1919, portions of which have been previously noted (*E. S. R.*, 47, p. 794). Part 1 of this report deals with the financial results for 56 farms of the dairying, mixed, and stock rearing and feeding classes, including 8,831 acres for the year ended November 11, 1920, and 7,866 acres for the year ended May 15, 1921. Part 2 sets forth the costs of production of grain crops; potatoes, turnips, and swedes; rye grass and clover hay; and grazing, as well as the cost of horse labor on 25 farms. Appendixes include tabulated data.

[**The cost of production of wheat, beets, potatoes, and milk in France, in 1921**], H. GIRARD (*Bul. Soc. Agr. France, 1922, Apr., Sup., pp. 39-45; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Prac. Agr., 13 (1922), No. 7, pp. 887-892*).—The author has ascertained the cost of production of these commodities by adding the total outlay to the general expenses, including the upkeep of material and maintenance by the tenant of buildings and farmyards, taxes, insurance, power and light, paid supervision, and sundry expenses. On the other hand, neither interest on capital invested, remuneration for management, nor reserve working capital has been included.



With respect to wheat the increase in the gross returns is only 95 per cent of the increase of the cost of production, and this even with an exceptionally good harvest. For beets used in sugar production, the increase in receipts is only 65 per cent of that of the expenses per hectare, owing to the bad harvests. For potatoes, which also suffered from the drought, the increase in receipts is only 71.7 per cent of that of expenses. The increase in the price realized for milk is only 76 per cent of that of the cost of production under fairly good economic conditions and exceptionally favorable conditions for sale direct to the consumer.

**The budget, the farmer, and the landowner, F. H. PURCHAS** (*Estate Mag.*, 22 (1922), No. 6, pp. 353-360).—This is a discussion of current problems and proposed legislation dealing with the assessment of the farmers' income tax in Great Britain.

**Taxation of agricultural estates, R. S. GARDINER** (*Estate Mag.*, 22 (1922), No. 3, pp. 137-145).—Details of Schedules A and B of the British income tax applying to agricultural property are given in these pages.

**The cooperative system and the financing of agriculture (Bengal, Bihar, and Orissa Coop. Jour., 8 (1923), No. 4, pp. 307-320).—The creation of the cooperative system for India is briefly related. The principal defects are said to be that societies do not distinguish between short-term and long-term loans, and that an inelasticity exists with regard to unforeseen seasonal demands and the disposal of seasonal surpluses. Suggestions are made for the improvement of the system.**

**The problem of the farmer, J. H. RICH** (*Minneapolis: Fed. Reserve Bank*, 1922, pp. 12, figs. 10).—This manual consists of reprints mainly from reports on crop and business conditions in the Ninth Federal Reserve District of dates between July 29, 1921, and November 28, 1922. Much of the information is presented graphically.

**The economic position of agriculture in the northwestern grain raising areas, J. H. RICH** (*Minneapolis: Fed. Reserve Bank*, 1922, 2. ed., enl., pp. 32).—This paper is based upon a statement presented to the annual conference of Federal reserve agents with the Federal Reserve Board in Washington, October 10, 1922.

It is concluded that in the area under consideration grain farmers are suffering a decreasing prosperity due to rising costs, gradually decreasing yields, radically increased taxation, and the existence of a farm labor problem of the most difficult character. It is held that additional credit will not help the farmer. Radical changes in the type of agriculture are impending, involving in all probability the elimination of the unfit and the creation of new sources of revenue to help bear the overhead, which is too heavy to permit a program of straight grain production.

**The cooperative marketing of farm products, O. B. JESNESS** (*Philadelphia and London: J. B. Lippincott Co.*, 1923, pp. XIII+292, pl. 1, figs. 57).—This volume is one of a series of Farm Manuals, edited by K. C. Davis. It purposes to point out the fundamental principles of cooperative marketing among farmers; to indicate what is being accomplished in the handling of farm commodities; and to discuss methods and forms of organization, financing and incorporation, the position of farmers' organizations under antitrust laws, and related questions. The business side of cooperative marketing has been especially emphasized. The specific commodities considered are grain, butter and cheese, milk, livestock, fruit and vegetables, cotton and tobacco, wool, and poultry and eggs. A number of review questions are drawn up at the end of each chapter.



**United States grades for rough rice**, H. J. BESLEY, E. G. BOERNER, and W. D. SMITH (*U. S. Dept. Agr., Dept. Circ. 290 (1923), pp. 10*).—The grades and classes recommended by the U. S. Department of Agriculture for the grading and marketing of rough rice are outlined.

**United States grades for milled rice**, H. J. BESLEY, E. G. BOERNER, and W. D. SMITH (*U. S. Dept. Agr., Dept. Circ. 291 (1923), pp. 17*).—Further revisions, effective August 1, 1923, are made in the grades for milled rice suggested previously (*E. S. R.*, 44, p. 39).

[Report of the] **division of agricultural economics**, J. D. BLACK ET AL. (*Minnesota Sta. Rpt. 1922, pp. 45-50*).—Brief reports are submitted with reference to investigations which are in progress at the station or noted earlier, and new projects are announced.

The conclusions are reached, from a study by H. Working of the forces determining the prices of farm products, that for the 27 years, 1890-1916, the value of the circulating medium has been completely determined by the quantity of that medium, the velocity of circulation, and the volume of trade; that changes in the general price level follow changes in the quantity of circulating medium by a period averaging slightly less than one year and may be predicted therefrom with a high degree of accuracy; that the contention that changes in the price level are not the results but the causes of changes in the quantity of circulating medium is definitely disproved; that changes in the general price level and other phenomena of the business cycle can be controlled by regulating the volume of bank deposits; that Fisher's plan for stabilizing the dollar would not take care of the price fluctuations incident to the business cycle; and that the hypothesis stated above fails to explain the high prices of the period from 1917 to 1920.

General conclusions based on the study previously abstracted (*E. S. R.*, 48, p. 688) are stated to the effect that the price of potatoes in Minneapolis and St. Paul is increasing slowly, relative to the prices of other commodities. Factors influencing the general price level affect the price of potatoes in the same degree that they affect the Bureau of Labor Statistics index number of wholesale prices. The greatest changes from year to year are due to variations in production in the entire United States, and loss in storage is an important factor in influencing the price of potatoes.

**New cultivation and colonization in Norway**, T. ILSAAS (*World Agr.*, 3 (1923), No. 2, pp. 249, 252, fig. 1).—Official measures promulgated November 20, 1920, are briefly set forth, and the progress of colonization is noted.

[Reports on agriculture in the Netherlands in 1921 and 1922], P. VAN HOEK (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. en Meded. Dir. Landb.*, No. 3 (1922), pp. LVI+124, fig. 1; *Dept. Binnenland. Zaken en Landb. [Netherlands], Verslag. en Meded. Dir. Landb.*, No. 3 (1923), pp. LXVII+112, fig. 1).—These annual reports with tabulated statistics continue the series previously noted (*E. S. R.*, 46, p. 597).

**Hungary's agricultural problems** (*Northwest. Miller*, 135 (1923), No. 7, pp. 669, 670, 686-689, figs. 9).—Difficulties in the way of loss of agricultural area and markets for corn and wheat are set forth in this article, which is profusely illustrated with typical agricultural scenes.

**Agriculture in Armenia** (*In Délégation de la République Arménienne. L'Arménie au Point de Vue Économique. Paris: Presses Universitaires de France, 1922, pp. 81-100*).—This chapter from a general report on the resources of Armenia gives a descriptive and statistical account of the agricultural and livestock industries.

**Agriculture [in Algeria in 1922]**, T. STEEG (*[Gouv. Gén. Algérie] Exposé Situation Gén. Algérie, 1922, pp. 462-472, 585-610*).—Annual reports on the pro-



duction of important crops, services for the encouragement of agriculture, and societies and banks for cooperative credit previously noted (E. S. R., 48, p. 393) are continued for 1922.

**Statistical information relating to stocks, cotton, grain, provisions, live-stock, seeds, crops, imports, exports, etc., of principal countries** (*Chicago: Howard, Bartels & Co., Inc., 1922, pp. 54*).—Compiled statistics up to December 31, 1922, are given here.

**Rural child welfare** (*New York: Macmillan Co., 1922, pp. [5]+355, pls. 8, fig. 1*).—The papers included in this volume are based upon an inquiry by the National Child Labor Committee into conditions in West Virginia, carried on under the direction of E. N. Clopper. Its contents are The Rights of Children and Standards for Their Welfare, by Clopper; The Rural Home, by C. E. Gibbons; Child Labor on Farms, by W. W. Armentrout; Rural School Attendance, by G. H. Folks; Rural Recreation, by R. G. Fuller; Rural Child Dependency, Neglect, and Delinquency, by S. A. Brown; Taxation and the Child, by H. L. Hazlett; and The Child and the State, by W. H. Swift. The appendix contains tabulated data.

### AGRICULTURAL EDUCATION.

**Rural education**, K. M. Cook (*U. S. Bur. Ed. Bul. 36 (1923), pp. 35*).—Advance sheets from the Biennial Survey of Education in the United States, 1920-1922, present a discussion of the definite signs of progress in the period. These include the tendency on the part of State departments to assume increased responsibility for rural schools; an increase in the number and scope of state-wide educational surveys with recommendations directed toward improvement of the rural school situation; renewed interest in and directed effort toward the improvement of the administrative organization under which rural schools operate in order to insure or make possible more liberal support and modern administrative practice; an increased appreciation of the dignity and importance of the office of the rural superintendent and the place of professional supervision in the improvement of rural schools; increased facilities for preparing teachers for the special field of rural education in State and other teacher-preparing institutions, accompanied by a growth in professional spirit among those engaged in rural education; the zeal with which a large number of States are centralizing and working for the centralization of several small schools into larger, more efficient ones; renewed efforts to supply high school facilities for rural children without taking them away from the farm; concerted efforts in nearly all States to improve rural school buildings and grounds, both as to sanitary conditions and those directly concerned with the use of buildings for school purposes; and widespread efforts to revise and improve the curriculum more nearly to meet the needs of country children.

**Report of a survey of the State institutions of higher learning in Kansas**, G. F. ZOOK ET AL. (*U. S. Bur. Ed. Bul. 40 (1923), pp. VIII+160*).—The Bureau of Education and the Kansas State Board of Administration conducted a survey of the University of Kansas, the Kansas State Agricultural College, Kansas State Normal School, State Manual Training Normal School, and Fort Hays State Normal School, and a statement of the findings is drawn up in these pages, together with recommendations.

**Hampton Normal and Agricultural Institute, its evolution and contribution to education as a Federal land-grant college** (*U. S. Bur. Ed. Bul. 27 (1923), pp. V+118, pls. 13, fig. 1*).—A number of signed articles have been prepared under the direction of W. C. John, presenting the history, organization,



and finances of this institution and the aims and methods of the schools of which it is composed. An introduction has been prepared by W. H. Taft.

**Methods of teaching used at the Western Washington Experiment Station of the State College of Washington in the six-weeks poultry short course,** MRS. G. R. SHOUP (*Poultry Sci.*, 2 (1923), No. 4, pp. 136-138).—A brief outline of the aim and content and of the methods of presenting the subject matter is given.

**The Iowa plan for training superintendents and teachers for consolidated schools,** M. CAMPBELL (*U. S. Bur. Ed. Rural School Leaflet* 17 (1923), pp. 5).—An account of the methods used at the Iowa State Teachers' College, which endeavors to meet the needs of students preparing to teach in consolidated schools by preparing them in the standard curriculum and in the appreciation of country life problems.

**An elementary textbook of Australian forest botany,** C. T. WHITE (*Sydney: Forestry Commrs. N. S. Wales*, 1922, vol. 1, pp. [IV]+223, figs. 105).—A textbook of botany is offered for Australian forestry students and forest officers.

**Dairy laboratory manual and notebook,** compiled by E. L. ANTHONY (*Philadelphia and London: J. B. Lippincott Co.*, 1923, 3. ed., rev., pp. 77, figs. 16).—This is a third edition of the manual previously noted (*E. S. R.*, 37, p. 872).

**Farm accounting in rural schools** (*Ohio Agr. Col. Ext. Circ.*, 9 (1923-24), No. 2, pp. 24).—A simple system of keeping records of farm receipts and expenses is described here.

**Score cards for fairs** (*Wash. State Col. Ext. Bul.* 107 (1923), pp. 29).—Score cards are presented for scoring exhibits in bees and honey, breeding stock, dairy stock, farm crops, fruits and vegetables, and poultry from a utility basis.

### MISCELLANEOUS.

**Thirtieth Annual Report of Minnesota Station, 1922,** W. C. COFFEY ET AL. (*Minnesota Sta. Rpt.* 1922, pp. 151, figs. 12).—This contains the organization list, a financial statement for the fiscal year ended June 20, 1922, and reports of the director, heads of divisions, and the various substations. The experimental work not previously reported is for the most part abstracted elsewhere in this issue.

**Twenty-ninth Annual Report of Montana Station, 1922,** F. B. LINFIELD ET AL. (*Montana Sta. Rpt.* 1922, pp. 38).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1922, and a report of the director and heads of departments on the work of the station. The experimental work reported is for the most part abstracted elsewhere in this issue.

**Report of West Virginia Station, 1921-1922,** H. G. KNIGHT ET AL. (*West Virginia Sta. [Bien.] Rpt.* 1921-22, pp. 465-502, pls. 2).—This contains a financial report for the fiscal years ended June 30, 1921 and 1922, and reports of the director and heads of departments on the work of the station during the biennium.

**Monthly Bulletin of the Ohio Experiment Station** (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 9-10, pp. 129-160, figs. 18).—This number contains six articles abstracted elsewhere in this issue.

**Bimonthly Bulletin of the Western Washington Station** (*Western Washington Sta. Bimo. Bul.*, 11 (1923), No. 4, pp. 65-88, figs. 4).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Fall Work in the Berry Field, by H. D. Locklin; Diseases and Insect Pests of Raspberries and Their Control, by A. Frank; Fall Plowing or Spring Plowing? by M. E. McCollam; Are You Considering Planting More Fruit? by Locklin; and Short Courses for Western Washington Farmers.

## NOTES.

---

**Arkansas Station.**—The departments of agronomy and plant pathology have recently secured appropriations to build a greenhouse to be used by the two departments jointly for research work.

**Porto Rico Federal Station.**—W. V. Tower has resigned as entomologist to engage in commercial entomological work in Porto Rico. Thomas Bregger, plant breeder, has resigned to accept a position with the Argentine Government.

**Tennessee University.**—The school of home economics has been made a department of the College of Agriculture.

**Washington Station.**—Feeding trials to determine the most economical use of home-grown feeds and the value of certain concentrates in the ration, involving 1,000 head of cut-back lambs and 90 head of 2-year-old steers, are now under way at the Irrigation Substation at Prosser. At this substation there was produced this year 350 tons of alfalfa hay and 275 tons of corn silage. The substation has been fully equipped for feeding trials with both lambs and cattle, and through its work the Yakima Valley, in which large quantities of hay are produced, is becoming interested in feeding cut-back lambs and cattle produced on the range.

Dr. Paul W. Allen, head of the division of bacteriology, has resigned to accept a similar position at the University of Tennessee. Dr. S. C. Vandecaveye of the Iowa College has been appointed acting head of the division of bacteriology.

**Association of Official Agricultural Chemists.**—The thirty-ninth annual convention of the association was held November 19–21, 1923, at Washington, D. C., with about the usual registration and attendance.

In addition to the customary reports of the referees and associate referees, the following papers were presented: A Rapid Method for the Determination of Lead in Lead Arsenate, by C. C. Hedges and W. S. Stone; A Quick Method for Determining Water-Soluble Arsenic in Lead Arsenate and Zinc Arsenite, by R. C. Roark, presented by C. C. McDonnell; A Preliminary Notice Concerning the Color and Composition of American Honeys, by W. Seaman; The Lead Number of Maple Products, by C. A. Clemens; A Polariscopes Method for the Estimation of Diastatic Power, by H. C. Gore; An Interpretation of the Results of the Determination of the Availability of Organic Nitrogen in Fertilizers, by C. S. Robinson; A Study of the Availability of Organic Nitrogen in Mixed Fertilizers, by G. Hart; Observations Upon the Analysis of Double Superphosphate, by E. L. Larison; Determination of Phosphorus, by J. B. Mudge; An Improved Method for the Separation of Unsaponifiable Matter of Fats and Oils, by R. H. Kerr and D. G. Sorber; Composition of the Flesh of Squabs and Pigeons, by C. R. Moulton; and Determination of Fat in Cacao Products, by L. Feldstein, presented by V. A. Pease.

The program for the second day included the address of the retiring president, A. J. Patten, who spoke on The Relation of Colloid Chemistry to Agriculture, and that of the honorary president, H. W. Wiley, who chose for his general subject Chemistry in Relation to National Defense. Brief informal talks were given during the session by C. A. Browne, the newly appointed chief of the Bureau of Chemistry, U. S. D. A., and by H. E. Howe, editor of



*Industrial and Engineering Chemistry.* The latter discussed the attempts being made by the American Chemical Society to interest high school and college students in chemistry and allied subjects, and announced the prize essay contest, which is being conducted throughout the country under the auspices of this society. The Secretary of Agriculture also addressed the association briefly.

An innovation in the committee reports of the final session was a public session of the committee on definition of terms and interpretation of results on fertilizers. This gave an opportunity for representatives of fertilizer industries to express their views concerning definitions and standards. R. E. Doolittle, as chairman of the committee on editing methods of analysis, reported that the revised edition of the Official Methods, which will be materially increased in size, will probably be issued about the middle of 1924. There was considerable discussion concerning the advisability of including a bibliography in the new edition, and a committee of which W. W. Skinner is chairman was appointed to consider this question.

The officers of the association for the coming year are as follows: President, R. E. Doolittle; vice-president, C. A. Browne; and secretary-treasurer, W. W. Skinner. In closing, resolutions were adopted on the death of two members of the association, Dr. F. C. Cook and F. W. Woll.

**American Farm Economic Association.**—The fourteenth annual meeting of this association was held in Washington, D. C., December 27–29, 1923. The proceedings began with a joint session with the American Economic Association and allied societies. On this occasion, business conditions in the United States and Europe were discussed by several speakers.

The meetings of the association itself were presided over by Dean T. P. Cooper of the Kentucky University and Station, portions of whose presidential address are discussed editorially in this issue. The first speaker was Secretary Wallace of the U. S. Department of Agriculture. His paper was entitled *A National Agricultural Program—A Farm Management Problem*, and in it he urged primarily a better adjustment in the program of production on individual farms without implying, however, an increased output. He maintained that a two-year farm management program for the nation must include good farming, good farm management, the making available to the farmer through Government agencies of knowledge which he needs, a more rapid dissemination of knowledge concerning credit, an immediate reduction in freight rates so far as commensurate with adequate service to the farmers, and the disposition of surplus crops in such a way as to bring up domestic prices. He held that the free operation of economic laws is working evil for the farm group, which is entitled to Government protection equal to that given to other business interests, although any Government program designed to bridge the present period of depression must insure future stability. Some of the activities he recommended were scientific research, the direction of land settlement, a survey of land resources, land reclamation with the view to meeting the public need, an effort to build up lease systems which will benefit the land as well as both contracting parties, the encouragement of crop insurance, studies of marketing, and the improvement of transportation with the greater use of highway and water routes.

Discussion of the topic of cooperative marketing was opened by H. E. Erdman, who defined commodity marketing and enumerated some of its elements of strength and weakness. In the ensuing discussion, some dissatisfaction was voiced with the term "commodity marketing," along with an appreciation of the necessity for varying the form of cooperative organization with particular crops and in particular localities. No consensus of opinion as to the ad-



visability of integration or as to the relative advantages of strong central or local units was reached. Considerable emphasis was put upon the need for reliable, adequate cost accounting.

A paper on Agricultural Forecasts, Their Use and Value, by H. C. Taylor, described the work of the U. S. Department of Agriculture particularly in the way of estimates of acreage and condition and intention surveys. The latter have been carried on in an effort to arrive at an estimate of the probable supply with relation to the probable demand. The work of a special committee on land utilization attempting to determine the probable demand upon land for crops, livestock, and forests, was noted in this connection, as well as the studies of two special commissions on the agricultural outlook.

L. Peavy presented a paper for R. W. Babson, in which a discussion of the effect of business upon agriculture was illustrated with charts, visualizing the effect of industrial development in drawing laborers away from the farms and increasing the price of farm labor, the response of prices of agricultural products to seasonal and fundamental conditions, and other phenomena. Prices of agricultural products, especially wheat, were shown to be usually at variance with commercial and industrial trends over periods of expansion and deflation, but the net values of agricultural and industrial commodities showed close similar trends and amounts. Farm mortgage rates seemed to correspond more closely to business than to crop conditions. Industrial development on the whole was said to benefit agriculture. In his discussion of this paper, E. H. Thompson touched upon the effect on farm prices of concentration of population in industrial centers, near which farms take on added values as residence properties for the families of factory workers. A. B. Genung made a point of the domination of agriculture by the urban community and pointed out a tendency toward greater dependence upon the domestic market as one means of adjustment. G. C. Haas, in an analysis of business cycles and agriculture, disagreed with the idea that the farmer does not vary his production with price conditions, pointing out a correspondence between cotton acreage and price.

G. F. Warren based his attempt to determine the future trend of farm prices upon three economic factors, the quantity of money in circulation and cycles of over and under production and of over and under demand. He asserted that since capital turnover requires eight years the farmer is primarily interested in long-time trends and concerned with the ratio of the purchasing power of agricultural products to taxes and interest. He anticipated a general downward trend of prices for 10 or 15 years, and economic events paralleling those following the Civil War. He advised care on the part of the farmer in buying anything priced now above the pre-war level unless it is expected to pay for itself quickly. He outlined briefly anticipated cycles of prices of various classes of livestock. F. V. Waugh presented some practical problems of publishing predicted prices of specific commodities and of giving dealers a method of predicting prices for themselves.

A suggestive paper was presented by Dr. Taylor on the subject of the content of a course in the business of agriculture at the college of agriculture. This included a maximum of courses to be offered in economic and agricultural geography and history, money and banking, accounting, economic law, general agricultural economics, cooperation, and agricultural writing and advertising. He indicated numerous positions which were open to students trained in such courses. In the course of the ensuing discussion, Dr. Warren gave an informal report of the committee on teaching, enumerating the aims of teaching as giving students some conception of the relation of the Government to agricu-



ture; of how to conduct a farm, this phase to be known as farm management; and how to handle the products of the farm, which he designated as business administration.

The committee appointed to represent the association in cooperation with a similar committee of the American Country Life Association in the preparation of a syllabus on social and economic aspects of farm questions was continued. The appointment was announced of O. E. Baker, R. T. Ely, and J. R. Smith as a committee on teaching forestry economics in agricultural colleges, high schools, and graded schools.

A paper submitted by A. Leitch was concerned with the question of the allocation of rent and interest in farm cost accounting and the difficulties arising out of the great preponderance of joint costs.

An account of analyses of farm business which have been made for seven years on cost accounting routes in Steele County, Minn., was presented by G. A. Pond, who pointed out the success of such studies and demonstrations in convincing farmers of needed adjustments in farm organization. R. H. Wilcox held that shifts in the proportions between the various units of the business can be brought about effectively with increasing net returns to farmers. J. R. Fain discussed the development of livestock production in the Coastal Plain and Piedmont regions of the Southeastern United States, where the industry is predicated on using pastures twelve months of the year. He set forth the possibilities of improving pastures by the improvement of native grasses and forage crops, and advocated the planting of alfalfa, lespedeza, Sudan grass, and other crops. W. D. Nicholls presented in detail results of livestock feeding experiments and farm organization studies in Mason and Fleming Counties, Ky.

The present land situation in England was discussed by J. I. Falconer, who reviewed historically the difficulties of the landowners, efforts to establish small holdings, and cooperative farming schemes in England. Some reasons assigned for the unprofitableness of estate ownership, particularly since the war, have been the low return on capital valuation, increased farming costs, higher mortgage rates, death duties, taxes, tithes, and rates, and indirectly the agitation by the labor party against the landowners. A paper contributed by DeW. C. Wing urged a breaking up of large estates in the United States before the same necessity arises which is forcing it in England. He enlarged upon the decrease in land purchases in the United States and voiced a fear of the development of a peasant class. B. H. Hibbard attributed the fall in land values and rentals largely to England's industrial development and labor difficulties.

A paper by H. C. M. Case, pertaining particularly to the feed lot phase of the beef cattle business in relation to farm organization, brought forward data comprising a financial summary of 2,950 farms in Illinois over a 7-year period. The proper place and extent of the beef cattle industry on the farm, involving the utilization of rough land and of farm raised roughage, the opportunity for the employment of man and horse labor particularly between October and May, and the value of fertilizer returned to the land, was discussed. An appreciable increase in the farm income as the result of the proper conduct of the beef cattle feeding enterprise was pointed out.

A notable paper by W. J. Spillman setting forth the law of diminishing increment in the feeding of cattle and hogs concluded the addresses. A number of curves had been plotted, showing the total weight of animals with increasing increments of feed and how, particularly after a period when the young animal is consuming chiefly milk, the increases in its weight form the terms of a decreasing geometric series. The mathematical deductions were shown to be borne out by experimental results.



Reporting for the committee on investigations, E. G. Nourse recommended a systematic study of the economic value of standardization in agriculture and of methods, and submitted a request from a life insurance company for a productive inquiry into the field of insurance in farming. H. M. Dixon reported in detail upon the answers received by the committee on extension in farm economics to a questionnaire to county agents and other leaders as to their work in marketing and junior accounting extension work.

The report of the committee on terminology, submitted by L. C. Gray, was concerned with the definition of the terms gross and net product of the farm. It suggested the use of the expression "gross value product," to include (1) the value of all livestock products of the year; (2) the increase of the value of all livestock sold up to the time of sale, i. e., the difference between initial inventory price or sale price and the difference between purchasing or sale price; (3) the increase in the value not due to changes in price of all livestock not sold; (4) the value of crops produced and not used for seed or feed, including woodlot products, where they are incidental to the farm and not a major; and (5) material obtained from the farm, but not including receipts from labor. The net value product would then be the gross value product less deductions for fertilizer not produced on the farm during the current year; other supplies; blacksmith and other incidental expenses, not including taxes or interest; machinery, not including that part of depreciation used off the farm; and value of family labor and operator's labor, not including the value of the residence used by hired labor. Other phrases defined were operator's net return, the operator's income from the farm business, and the family income from the farm business, as well as of the terms "land value" and "price of land."

A resolution expressing the approval of the association for a proposed national or international institute of cooperation to be conducted for approximately six weeks in the summer under the auspices of an accredited educational institution was adopted.

An amendment to the constitution was adopted, extending the privilege of associate membership, at one-half the rate for regular members, to graduate students below the rank of instructor who may belong to a local chapter. A tentative plan for trial in 1924 to promote local chapters by a division of the annual dues was also worked out.

The following officers were elected for the ensuing year: President, E. G. Nourse; vice president, W. I. Meyer; and secretary-treasurer, J. I. Falconer.

**Miscellaneous.**—Dr. George H. Pethybridge, formerly mycologist of the Department of Agriculture and Technical Instruction of Ireland, has accepted an appointment as mycologist for the Ministry of Agriculture and Fisheries of England. The research work which he has been conducting in plant pathology has been placed in charge of Dr. P. A. Murphy. H. A. Lefferty has been appointed head of the Irish Department Seed Testing Station.

Lawrence Ogilvie has been appointed plant pathologist of the Bermuda Department of Agriculture.

Dr. Carl R. Fellers has been appointed associate professor in charge of the newly established department of food preservation, University of Washington.

---

ADDITIONAL COPIES  
OF THIS PUBLICATION MAY BE PROCURED FROM  
THE SUPERINTENDENT OF DOCUMENTS  
GOVERNMENT PRINTING OFFICE  
WASHINGTON, D. C.  
AT  
10 CENTS PER COPY  
SUBSCRIPTION PRICE, 75 CENTS PER YEAR



# EXPERIMENT STATION RECORD.

VOL. 50.

ABSTRACT NUMBER.

No. 3.

---

## RECENT WORK IN AGRICULTURAL SCIENCE.

---

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

**Elements of horticultural chemistry**, A. FURST (*Eléments de Chimie Horticole*. Namur, Belgium: E. Dubois, 1922, pp. II+144, pls. 16, figs. 20).—This volume deals in an elementary way with the chemistry of plants, soils, fertilizers, insecticides, and fungicides, and with miscellaneous topics of interest to the horticulturist from a chemical standpoint.

**Analytical chemistry of the alkaloids**, K. H. BAUER (*Analytische Chemie der Alkaloide*. Berlin: Borntraeger Bros., 1921, pp. V+425).—This reference book contains a general section dealing with the various methods for detecting, isolating, and determining alkaloids, followed by a special section in which information is given on the properties, qualitative tests, and quantitative reactions for individual alkaloids.

**Hydrogenated oil for oil baths**, G. R. ROBERTSON (*Indus. and Engin. Chem.*, 15 (1923), No. 7, p. 701).—The author recommends the use of hard hydrogenated vegetable oils such as hardened sesame and cottonseed oil for oil baths. These oils, which are intermediates in the manufacture of shortening products, melt at about 60° C. to a clear mobile oil, and have minimum flash points of 320° for the hard sesame oil and 305° for the hard cottonseed oil. Both are considered to be superior to vaseline and paraffin, more convenient than untreated vegetable oil, and much cheaper than fusible metals.

**The solvent properties of acetone**, R. F. REMLER (*Indus. and Engin. Chem.*, 15 (1923), No. 7, pp. 717-720, figs. 2).—Data are presented and discussed on the efficiency of acetone as a solvent for acetylene, cellulose triacetate, cellulose nitrates, celluloid, gums, resins, oils, and fats. Among the advantages claimed for acetone as a solvent are its complete miscibility with water, which makes it an excellent dehydrating agent; its miscibility in many other solvents, thus permitting its use with these solvents; its purity as commercially prepared; its low boiling point; and its low inflammability as compared with benzene, petroleum ether, or gasoline.

**Micro-sampling for the determination of dissolved oxygen**, R. V. ALLISON and J. W. SHIVE (*Soil Sci.*, 15 (1923), No. 6, pp. 489-491, fig. 1).—An apparatus for use in the determination of dissolved oxygen in samples from such small sources as 1- or 2-liter bottles by the micro Winkler method is described and illustrated.

**The determination of solids (or moisture) by means of a gauze dish**, A. SEIDENBERG (*Indus. and Engin. Chem.*, 15 (1923), No. 7, pp. 737-741, fig. 1).—A modification of the gauze dish previously described (*E. S. R.*, 34, p. 206)

has been used in a large number of moisture determinations made on various sugars and other solutions in comparison with the pumice stone method. In its present form the gauze dish is made of fine mesh platinum gauze with an area of 200 sq. cm., corrugated into 31 to 33 lateral ridges, and thus compressed into an area of 8.5 by 5.5 cm. The dish rests on a platinum-gold stand and is protected during weighing by placing in a closed dish made of thin, light-weight lead sheets.

The liquid should be weighed by difference and distributed 1 drop at a time in rows running lengthwise. About 2.5 to 3 gm. should be thus distributed in 100 drops. For highly viscous solutions, the concentration should be between 10 and 20 per cent and for others between 20 and 30 per cent. The highest temperature which will not produce decomposition should always be used. This would range from 50 or 60° C. for organic solutions containing levulose and other similar substances which are readily decomposed to a temperature of from 110 to 125° for organic solutions containing material that does not readily decompose. The weighings to establish the rate of loss and the attainment of constant weight should be made at intervals of from 2 to 4 hours. The end point, as represented by the difference between the rate of loss due to evaporation and that due to decomposition, is said to be quite distinct.

Data are reported on the use of the dish in the determination of total solids in molasses, sirups, sweetened condensed milk, evaporated milk, and natural milk.

**The determination of carbon in vegetable mold,** L. J. SIMON (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 20, pp. 1409-1411).—The author recommends the following technique for the determination of carbon in humus:

From 0.4 to 4 gm. of the soil, depending upon its richness in carbon and its homogeneity, is placed in a small conical flask containing from 25 to 30 gm. of concentrated sulphuric acid and from 8 to 12 gm. of silver dichromate. The flask is connected with a 250 cc. gauge and is placed on a water bath which is heated gradually so that the boiling point is reached in 30 minutes. This temperature is maintained for 4 minutes, after which the apparatus is cooled and the volume of the gas evolved is read at atmospheric pressure.

The results are reported of the determination of carbon in three different soils by the method described, the cupric oxid method, and the chromic oxid method. The results obtained by the first two methods were in close agreement, while those obtained with chromic anhydrid were consistently lower, probably on account of the formation of acetic acid. Drying the samples in air is thought to give better results than drying them in the oven at 110° C.

**Comparative studies of various methods for the chemical determination of humus in soil,** V. AGAFONOFF (*Compt. Rend. Acad. Sci. [Paris]*, 177 (1923), No. 6, pp. 404-406).—The results are reported of humus determinations on 10 Russian and Rumanian soils by the combustion method, the method of Simon, noted above, and the chromic acid method. For purposes of comparison, determinations of the chlorin index are also included.

The tabulated results show close agreement in the percentages of carbon as determined by the combustion method and that of Simon. The figures obtained by the chromic acid method were consistently lower, as noted in the above paper. In some of the samples the differences between the results obtained by the two methods were much more marked than in others. The chlorin indexes corresponded qualitatively to the figures obtained by the combustion and Simon methods, the soils richest in humus being those of the highest chlorin index.

It is concluded that the method of Simon can to good advantage replace the combustion method, and that if the Simon method and the chromic acid oxida-



tion method are applied to the same soil some indication can be obtained as to the chemical nature of the humus of the soil analyzed. For approximate indications of the quantity of humus contained in a soil, determinations of the chlorin index are recommended.

**A modification of the Truog soil acidity test,** F. W. PARKER and J. W. TIDMORE (*Soil Sci.*, 16 (1923), No. 1, pp. 75-78).—Slight modifications in the technique of the Truog test for soil acidity (*E. S. R.*, 43, p. 622) are described, the use of which is said to make possible the determination of slight differences in acidity which can not be detected by the original method.

In the modified test the amount of soil used has been increased from 10 to 20 gm. and the time of boiling from 2 to 3 minutes. The amount of hydrogen sulphid evolved on boiling the soil with the Truog reagent is determined accurately by titration with a standard iodine solution instead of using lead acetate test paper.

**Effect of adsorption and other factors on certain plant food constituents obtained in the dilute nitric acid digestion of soils, and an improvement for their estimation,** O. M. SHEDD (*Soil Sci.*, 15 (1923), No. 5, pp. 383-393).—Studies conducted at the Kentucky Experiment Station are briefly reported, the purpose of which was to extend the application of the N/5 nitric acid digestion method to soil plant nutrients other than phosphorus as a means for determining their availability to plants. Ninety-two soils, representing the different soil areas in Kentucky, were used.

The results showed that there were 30 samples in which the percentage of phosphorus, 5 in which the percentage of potassium, and 16 in which the percentage of calcium found by the short digestion equaled or exceeded the percentages of those elements obtained by longer extraction. The silicon obtained by the short digestion was less in every sample. The average results from all the samples showed that 91 per cent of the phosphorus, 89 per cent of the potassium, 94 per cent of the calcium, and only 28 per cent of the silicon were obtained in the short 5-minute digestion as compared with the regular 5-hour digestion procedure.

The results are further taken to indicate that adsorption in some soils is a factor which may appreciably affect the availability results obtained for certain plant nutrients in the N/5 nitric acid method as ordinarily used. "With such soils, therefore, the result usually reported for the prescribed 5-hour period represents the quantity dissolved by the acid during this time less the amount subsequently withdrawn from solution by the soil during the same time due to adsorption. Assuming that the latter is not an instantaneous process, the less time that the soil is in contact with the acid would be advantageous in partly overcoming this effect. The short digestion is therefore preferable on this account inasmuch as the averages obtained in this work show that it gives about as good results and moreover shortens the regular procedure."

The addition of calcium carbonate to the soil increased the amount of phosphorus and decreased the amount of potassium found in the N/5 nitric acid extract of most of the soil samples. On the other hand, failure to dry the sample for the acid digestion appeared to exert a variable influence on the amount of the above elements found in solution as compared with a similar digestion of the air-dried soil.

It is concluded that weak acid digestion, especially of short duration, is valuable for indicating possible deficiencies of plant nutrients in soils, provided it is used for purposes of comparison or in connection with a soil survey.

**Aeration method for determining ammonia in alkali soils,** W. M. GIBBS, R. E. NEIDIG, and H. W. BATCHELOR (*Soil Sci.*, 15 (1923), No. 4, pp. 261-268, figs. 2).—In this contribution from the Idaho Experiment Station, certain modi-



fications in the method of Potter and Snyder for determining ammonia in soils (E. S. R., 33, p. 411) are described, as a result of which complete aeration of the ammonia from 100 gm. of soil was obtained in from 1 to 1.5 hours at a temperature of from 75 to 85° C.

The most essential factors for the rapid and complete removal of the ammonia from the soil were found to be the temperature of the water and the rate of air flow. To maintain the temperature of the water in the trough at 75°, a simple heating arrangement consisting of a straight pipe through which steam is forced was introduced into the bottom of the tank. It was found that a satisfactory air flow could be secured by placing the end of the tube dipping into the solution at about  $\frac{1}{4}$  in. from the bottom of the flask. The modified apparatus is described and illustrated, and data are reported on the application of the method with a neutral silt loam soil of average fertility and with samples of dried blood and different amino acids.

**Differentiation of proteins by the Abderhalden reaction, particularly urine proteins,** F. ISHIWARA (*Ztschr. Immunitätsf. u. Expt. Ther.*, I, Orig., 37 (1923), No. 3, pp. 238-248, fig. 1).—A modification of the Abderhalden ninhydrin test for the differentiation of proteins is described, by means of which it is said to be possible to differentiate between plant and animal proteins, organ and blood proteins of different animals, and the proteins of beef, horse meat, and pork.

**The determination of urea alone and in the presence of cyanamid by means of urease,** E. J. FOX and W. J. GELDARD (*Indus. and Engin. Chem.*, 15 (1923), No. 7, pp. 743-745).—Methods are described for the determination of urea alone, in commercial cyanamid, and in mixtures of cyanamid with acid phosphate and calcium phosphate. The methods are based on the conversion of urea to ammonium carbonate by the action of the enzym urease, which is freshly prepared for each determination by extraction from jack bean flour.

**The quantitative determination of tryptophan,** G. E. HOLM and G. R. GREENBANK (*Jour. Amer. Chem. Soc.*, 45 (1923), No. 7, pp. 1788-1792, fig. 1).—Various methods of determining tryptophan are reviewed and discussed, particularly the colorimetric methods employing *p*-dimethylaminobenzaldehyde as in the method of Herzfeld.<sup>1</sup> Data are reported on the influence of temperature and time upon this reaction. With 20 per cent hydrochloric acid, a temperature of 37° C. and a time of 8 days were found to give the best results. For the determination of pure tryptophan in solution or in a mixture of amino acids, the use of approximately 2 mols of aldehyde to each mol of tryptophan present is recommended. The tryptophan content of proteins can be determined without previous hydrolysis of the protein, although it is thought that an enzym-digested protein is better suited for this determination than is undigested protein.

**Methyl anthranilate in grape beverages and flavors,** R. D. SCOTT (*Indus. and Engin. Chem.*, 15 (1923), No. 7, pp. 732, 733).—A study of the various factors influencing the reaction in the test for methyl anthranilate, as described by Power (E. S. R., 45, p. 207), has led to the development of a gravimetric procedure as follows:

“Twenty-five cc. of sample was diluted to 100 cc. and steam distilled to 500 cc., using a mercury seal and cooling the receiving flask in ice water. An aliquot of 200 cc. was diazotized for 1 minute with 5 cc. of *N* hydrochloric acid and 2 cc. of 5 per cent sodium nitrite solution. The diazotized solution was poured into 25 cc. of 0.2 per cent solution of  $\alpha$ -naphthol in 30 per cent ethyl alcohol, and 6 cc. of *N* sodium bicarbonate. After 10 minutes the pre-

<sup>1</sup> *Biochem. Ztschr.*, 56 (1913), No. 3, pp. 258-266.



precipitate was filtered on a 30-cc. weighed Gooch crucible, washed with 100 cc. of water, dried at 100° C. for 2 hours, and weighed. Weight precipitate times 0.4935 equals weight of methylanthranilate."

This method is applicable to the determination of methyl anthranilate in artificial grape concentrated extracts. For the examination of grape juices and grape pops a colorimetric procedure is followed. A 500-cc. sample is steam distilled, and a 100-cc. aliquot of the distillate is diazotized for 30 seconds with 1 cc. of N hydrochloric acid and 0.5 cc. of 5 per cent sodium nitrite, and is then poured into a Nessler jar containing 0.5 cc. of 2 per cent alcoholic  $\alpha$ -naphthol solution and 3 cc. of N sodium nitrite. The color which develops within 15 minutes and remains constant for several hours is compared with standards containing 0.000005, 0.00001, 0.000025, 0.00005, 0.0001, 0.00015, and 0.00025 gm. of methyl anthranilate which have been diazotized in the same way.

As tested by the colorimetric method, 8 brands of pure Concord grape juice contained from 0.8 to 1.49 parts per million and 4 brands of Catawba juice contained from 0.11 to 0.4 parts per million of methyl anthranilate.

**Researches on the adulteration of cacao butter**, M. PICHARD (*Ann. Falsif.* 16 (1923), No. 175, pp. 197-215, figs. 15).—Essentially noted from another source (*E. S. R.*, 49, p. 611).

**Propionic acid and ketones in whey**, E. O. WHITTIER and J. M. SHERMAN (*Indus. and Engin. Chem.*, 15 (1923), No. 7, pp. 729-731).—A more detailed report is given of an investigation of the factors affecting the propionic fermentation of lactose previously noted in a paper by Sherman and Shaw (*E. S. R.*, 50, p. 109).

The most favorable H-ion concentration for the propionic fermentation by the growth of *Bacterium acidi propionici* (d) alone or in the presence of *Lactobacillus casei* was found to be at the neutral point, pH=7. To maintain neutrality in the medium, 5 gm. of calcium carbonate was added to each 100 cc. of the culture.

It was found that the ratio of propionic acid to acetic acid could be altered by the presence of contaminating organisms or accelerating organisms purposely introduced. Organisms of the proteus type may be used to purify propionic acid from acetic acid if used in pure culture, but not when used in combination with other organisms.

A comparison of various sources of nitrogen for the growth of the organisms showed the proteins of whey to be more stimulating than either peptone or yeast. Increased concentration of lactose in the whey not only did not increase the yield of propionic acid but actually retarded the fermentation. Slightly greater yields of propionic acid in a given time were obtained with the use of cultures of the propionic acid organisms and *L. casei* which had been grown together than of the same organisms grown separately. A 5 per cent concentration of the inoculum was found to be the most practical quantity for maximum yield.

The possibility is suggested of utilizing the products of propionic fermentation for conversion into ketones. Distillation of the dried calcium salts with fractionation through a narrow 2-ft. column of beads gave a final distribution of the fractions indicating approximately 20 per cent acetone, 40 per cent methylethyl ketone, and 40 per cent diethyl ketone.

**Expression of quantity of water-soluble arsenic present in commercial lead arsenates**, C. A. KLEIN and W. HULME (*Indus. and Engin. Chem.*, 15 (1923), No. 7, pp. 745, 746).—Attention is called to the fact that "the method now used for the expression of the water-soluble arsenic content of lead arsenates is considered to be irrational, since it ignores the fact that the quantity of water-soluble arsenic present in a spraying mixture is determined,



not solely by the quantity in which it is present in the arsenate as sold, but by the total quantity of the arsenic present, the latter being the factor which determines the proportions of commercial lead arsenate and water used in making up spray mixtures. It is suggested that, in order to establish a better standard of comparison between the water-soluble contents of lead arsenates of varying composition, the former shall be calculated and expressed as a percentage of the total arsenic present. It is also suggested that all analytical values shall be determined on the samples as received, but shall be expressed on the basis of dried material, and not, as is frequently the case, on the samples as received, which may be in the dry or paste form, the water content of the latter being known to vary within wide limits."

**Starch in sorghum juice**, S. F. SHERWOOD (*Indus. and Engin. Chem.*, 15 (1923), No. 7, pp. 727, 728).—The results are reported from the Bureau of Plant Industry, U. S. D. A., of the determination by the diastase method of the starch content of juice prepared from 15 varieties of sorgho cut at the usual time of harvesting for sirup production.

The starch content of the different juices varied from 0.142 per cent in the case of honey sorgho to 0.852 per cent for the variety known as Rex X. The average value for all of the varieties tested was 0.366 per cent. High starch values were invariably accompanied by high sucrose and low reducing sugar values. In discussing the significance of the data in connection with breeding experiments and varietal tests, it is pointed out that in view of the large areas in the United States suited to the production of sugar beets and sugar cane it is not necessary at present to consider sorgho for sugar production, but that it is of great value for sirup. For this purpose a juice low in starch and consequently high in invert sugar would be the most satisfactory.

**The preparation of standard cotton cellulose and the proposed methods of analysis**, H. HIBBERT ET AL. (*Indus. and Engin. Chem.*, 15 (1923) No. 7, pp. 748-751, fig. 1).—This report of the committee of the subdivision of cellulose chemistry of the American Chemical Society consists of two parts. The first is a description of the method of preparing standard cotton cellulose as accepted by the cellulose division, with analyses by W. O. Mitscherling of various American cottons. The second part gives in detail proposed methods for the analysis of standard cotton cellulose for ash, nitrogen, furfural, and the copper, cellulose, and hydrolysis numbers.

**Contributions to chemistry of wood cellulose.—II, Nature of wood cellulose**, L. E. WISE (*Indus. and Engin. Chem.*, 15 (1923), No. 7, pp. 711-713, figs. 3).—In this discussion of the nature of wood cellulose, the author presents the working hypothesis that both cotton and wood cellulose consist of small cellulose units held together "by forces which, for the lack of a better name, may be referred to as secondary or auxiliary valences." The wood cellulose in addition contains a small number of other units such as mannans, pentosans, methyl pentosans, and galactans which are adsorbed by the cellulose units during the process of growth. This theory would explain the presence of mannose, furfural, etc., in the hydrolysis products of wood cellulose and also the resemblance between purified wood cellulose and cotton cellulose.

**Distribution of methoxyl in the products of cooking jack pine by the soda process**, S. S. AIYAR (*Indus. and Engin. Chem.*, 15 (1923), No. 7, pp. 714-716, fig. 1).—In continuation of the studies on the distribution of methoxyl in the products of wood distillation (*E. S. R.*, 48, p. 416), determinations were made by the same method of the methoxyl in the pulp of jack pine under different cooking conditions.

It was found that as the duration of cook was lengthened the methoxyl in the pulp fell rapidly for the first two hours and slowly thereafter. The



lignin and methoxyl contents of pulps from cooks of different duration, expressed in percentages of those of the wood, were practically identical, showing that the methoxyl is associated with the lignin.

### METEOROLOGY.

**The climate of the Great Plains as a factor in their utilization, J. B. KINCER** (*Ann. Assoc. Amer. Geogr.*, 13 (1923), No. 2, pp. 67-80, figs.).—The averages of annual precipitation, warm season precipitation, winter and summer temperature, and frost-free season are charted and discussed. A graph shows the variation in annual precipitation during 50 years, and data regarding evaporation and snow and hail are briefly summarized.

It is pointed out that "by selecting crops with the proper thermal requirements, each staple crop produced in the United States could be grown with profit in some section of the Great Plains, so far as temperature is concerned. The agricultural utilization of the region, however, is limited by moisture conditions, especially in the central and southern portions. There is a gradual decrease in the average annual precipitation from more or less humid conditions in the east to semiarid, or even arid, in the west. The average annual precipitation ranges from 20 in. in extreme eastern North Dakota to 25 in. in south-central South Dakota, central Kansas, and west-central Texas and Oklahoma, to less than 15 in. in much of Montana, eastern Wyoming, eastern Colorado, and the Brazos Valley in western Texas and eastern New Mexico. The minimum precipitation in the area is about 6 in. in the Bighorn Valley of Wyoming."

The seasonal distribution of the rainfall is very favorable for its fullest utilization, particularly in the northern part of the region. In general, however, there is less than the normal amount of rainfall in more than half of the years, and successive years of comparatively generous rainfall alternate with successive years of deficient precipitation, thus rendering farming by ordinary methods precarious. Evaporation during the warm season is high, especially in the south. The average annual snowfall ranges from about 30 in. in the Dakotas to 10 in. in northern Oklahoma and 1 in. in southwestern Texas. Hail is comparatively frequent over much of the region.

Temperature varies widely. Severe winter weather may be expected with cold, northerly winds reaching well into western Texas, but much of the winter season is dry and bracing and not uncomfortable for outdoor operations. Summer temperatures are more uniform than those of winter. The average summer temperature ranges from about 65° F. in the extreme north to more than 80° in the south.

The average frost-free period varies from 100-120 days in the extreme north to 160 days in east-central Nebraska and central-western Kansas, 200 days in northern Oklahoma and northwestern Texas, and 260 days in southern Texas. "The northward advance in spring of the average frost-free date line requires nearly three months, starting from the lower Rio Grande Valley about the first of March and reaching the northeastern part of Montana by the latter part of May. The advance is approximately at an average rate of 20 miles a day from west-central Texas northward. In general, the recession in fall is a counterpart of the spring advance as to rate and time required. The average date of the first killing frost in fall in the extreme northwestern portion is about September 10, and nearly three months later the frost line has receded to the southern border of the region."

**The weather and the farmer** (*Jour. Min. Agr. [Gt. Brit.]* 30 (1923), No. 4, pp. 298-303).—This is a brief explanation of the work of the British meteor-

logical service of special interest and value to farmers, and of the use that may be made of the various regular and special forecasts and long-period and current records of the service. Urging the wider popular use of such data, it is stated that study of the daily forecasts and maps, with some knowledge of the methods used by scientific forecasters, "will give anyone who cares to take a little trouble a useful stock of weather wisdom. And it is hoped that many will take this little trouble, for it is only by such general effort that the science of one generation can become the common knowledge of the next. . . . It is of great importance, too, that volunteers should be found to undertake the task of comparing general weather with local weather. . . .

"Much more information is still wanted as to the climatic requirements of each crop, and also as to the effect of the weather at any given period. . . . Vague statements concerning the weather are apt to be misleading, and the appearance of the growing crop is not the sole guide to the ultimate yield. But by carefully watching weather records and the changes in the growing crops, farmers should obtain much valuable knowledge of the effect of unusual rain or warmth, etc. By keeping such records themselves and afterwards measuring the yields of their crops, farmers will in time not only learn which weather conditions are really favorable or the reverse on their own soil, but will assist in solving the general problem of each plant's likes and dislikes."

**Meteorological and climatological bibliography of Argentina**, E. SPARN (*Acad. Nac. Cien. [Cordoba], Misc. No. 7 (1923), pp. 72*).—This is one of the series of bibliographies of scientific work relating to Argentina undertaken by the National Academy of Sciences of that country. It lists alphabetically by authors 520 references to literature on meteorology and climatology of Argentina and includes also an appendix listing 145 references to the literature of the meteorology and climatology of American antarctic and subantarctic regions. Special acknowledgment is made to Welch's bibliography, previously noted (*E. S. R.*, 46, p. 17).

**Weather forecasting**, V. BJERKNES (*Phys. Ztschr.*, 23 (1922), No. 22-23, pp. 481-490, figs. 3; *abs. in Sci. Abs., Sect. A—Phys.*, 26 (1923), No. 306, p. 340).—This is a review of the progress and present status of weather forecasting as a branch of applied physics, based upon the work of the author and his assistants and as illustrated by the methods of forecasting now used in Norway, which rest in large part upon the recognition of surfaces of discontinuity of the various elements separating masses of air of different quality in the atmosphere.

**Night frost**, I. D. VAN GULIK (*Meded. Landbouwhoogesch. [Wageningen]*, 27 (1923), No. 6, pp. 16, figs. 4).—This article is in Dutch with a short French résumé. It discusses various methods of predicting frosts, especially those used in the United States, and in detail the hygrometric method of Smith, previously noted (*E. S. R.*, 43, p. 15). Data regarding the last frost in spring and the first in autumn at six stations in the Netherlands are shown graphically and briefly discussed.

**Ozone of the upper layers of the air as a screen against the ultra-violet rays of the sun**, R. DIETZIUS (*Naturwissenschaften*, 11 (1923), No. 39, pp. 808-811).—Data recorded by Fabry and Buisson, Strutt, Wigand, and others are quoted to show that while the amount of ozone in the upper layers of the air is small it is a very active agent in absorbing the ultra-violet rays of the sun. It thus plays an important rôle in the plant and animal life of the earth, since these rays are chemically and physiologically the most active part of the solar spectrum as manifested in disinfecting power and destruction of living cells.



[**Solar radiation measurements**], C. G. ABBOT, F. E. FOWLE, and L. B. ALDRICH (*Ann. Astrophys. Observ. Smithsn. Inst.*, 4 (1922), pp. 45-320; pls. 6, figs. 41).—The progress made in perfecting instruments and methods of measuring and studying solar radiation is recorded, and the results of solar radiation measurements at Mount Wilson, Calif., Hump Mountain, N. C., and Calama, Chile, are reported in detail. The results are discussed with reference to variation of solar radiation and its relation to sun spots; temperature of the earth and radiation available to heat it, with detailed consideration of the factors determining the available heat; and utilization of solar energy for power and for cooking.

### SOILS—FERTILIZERS.

**Soils of Sheridan County [Mont.]**, L. F. GIESEKER (*Montana Sta. Bul.* 158 (1923), pp. 20, pls. 4, fig. 1).—This is a preliminary report of a physical survey, made in cooperation with the U. S. D. A. Bureau of Soils, of an area of approximately 1,700 square miles located in the extreme northeastern corner of Montana. The area has a typically glacial topography, and drainage is said to be well developed over the greater part. The soils also are of glacial origin. Soil maps showing the location and distribution of the different soil types are presented. It is stated that the topography is not favorable for the construction of dams and the irrigation of very large tracts. Consequently, the acreage under irrigation in the county is very small, totaling less than 500 acres.

**Chemical analyses of Montana soils**, E. BURKE and R. M. PINCKNEY (*Montana Sta. Bul.* 159 (1923), pp. 13).—Chemical analyses of a considerable number of samples of soils collected from different parts of Montana are presented and discussed, special attention being drawn to the wide variation in the amount of plant nutrients present in different soil types. Some of the analyses indicate that the corresponding soils are fairly well supplied with plant nutrients while others indicate deficiencies, particularly in lime, nitrogen, and possibly phosphorus. Soils in the central and eastern parts of the State are apparently well supplied with lime and contain sufficient nitrogen and phosphorus to produce good crops under proper tillage and moisture conditions. The data indicate that, in Montana, the soils in locations receiving the greatest amounts of precipitation invariably contain the greatest percentages of nitrogen.

[**Soil studies in India, 1921-22**] (*India [Dept. Agr.] Rev. Agr. Oper.*, 1921-22, pp. 50-56).—Studies of soil gases at the Pusa Agricultural Research Institute are said to have confirmed previous results (E. S. R., 47, p. 515) by showing that the soil atmosphere of the grassed plat is uniformly richer in carbon dioxide than either the trenched or cultivated plat, and that this difference is most marked during the monsoon months. The latter phenomenon is said to be associated with fairly high temperatures and heavy rainfall, and the conclusion is drawn that it is due to the decomposition of the organic detritus introduced into the soil from the roots of the grass. It has also been found that during the dry season the moisture content of the grassed plat becomes as low as 1 per cent, as compared with 1.3 and 5.5 per cent for the trenched and cultivated plats, respectively.

Studies of reclamation of saline soils in the Punjab are said to now indicate the importance of three processes, namely, (1) scraping off the superficial layer of salt, followed by cultivation, (2) heavy irrigation, followed by further flooding up to the time for cultivation, and (3) scraping and fallowing. Scraping appears to have given better results, as indicated by subsequent

crop yields, than mere flooding, and no appreciable rise of salt has been noted on the scraped and unirrigated land after the lapse of a year. The treatment of soil containing sodium carbonate with gypsum and castor cake permitted the growth of crops far superior to those grown on untreated soil.

Observation on the movements of nitrates in soil at Pusa are said to have shown that the distribution of nitrates through the subsoil is determined by climatic factors and by the physical characters of the subsoil layers. This distribution is considered to control in turn the growth of crops to a marked extent. Similar observations made at Cawnpore led to the conclusion that, under the ordinary system of cultivation in upper India, conditions are favorable for rapid nitrate accumulation immediately after the first rains of the southwest monsoon in June or July and at the beginning of the cold weather season in October. An investigation to determine the effect of moisture conditions upon nitrate formation in the soils of northeast India showed that in soils having a water content less than optimum, ammonia tended to accumulate and the formation of nitrate was slow. At a higher water concentration the ammonia accumulated was low, but there was a corresponding rise in nitrates. With much higher water content, ammonia was formed and gradually disappeared but did not remain as nitrate or nitrite.

Nitrogen fixation studies showed that in the Punjab a fixation of nitrogen amounting to an increase of 30 per cent of the total amount in the soil is common, and in one instance it reached 75 per cent without the addition of any carbohydrate. Studies at Pusa on symbiosis between algae and nitrogen-fixing bacteria and on the value of plant residues as nutrients for nitrogen-fixing bacteria showed that the abundant algal growth that took place in suitable media inoculated with soil and exposed to diffuse daylight was accompanied by a much higher fixation of nitrogen than in duplicate sets of medium kept in the dark, where algal growths were not visible. The fermented green manure was found to contain a readily available supply of nutrient material for the growth of *Azotobacter*.

The results of fertilizer experiments, particularly at Pusa, are also summarized.

**The chemical nature of a colloidal clay,** R. BRADFELD (*Missouri Sta. Research Bul.* 60 (1923), pp. 5-60, figs. 7).—Studies are reported in which the fresh subsoil of Putnam silt loam was suspended in five parts of water by churning, the coarser materials settled by gravity, and the finest colloidal material separated by means of a centrifugal force of about 30,000 times gravity. This fraction contained unusually large amounts of aluminum oxid and ferrid oxid, almost all of which was soluble in hot hydrochloric acid. This was taken to indicate that the colloidal fraction might be made up largely of the completely broken down end products of weathering, such as colloidal alumina, iron, and silica.

A synthetic mixture of these colloids, having a chemical composition similar to the natural colloid, was prepared and their physico-chemical properties compared. Cataphoresis studies showed that the natural colloid was negative and that the synthetic mixture was positive. The migration velocity of the natural colloid was decreased by traces of acids and increased by traces of alkali. Larger amounts of alkali caused flocculation. In no case was the direction of migration reversed. The synthetic colloid had a much stronger buffer action than the natural colloid, due apparently to its high content of free alumina. The natural colloid was flocculated most readily by polyvalent cations in an acid medium. The synthetic mixture was more sensitive to polyvalent anions and to alkalis.



Analyses were made of the fractions of each colloid soluble in dilute acid and in dilute alkali. Marked differences occurred throughout. The results as a whole are taken to indicate that the natural colloid is a complex aluminosilicate rather than a mixture of the separate colloidal oxids.

**The soil solution and its importance in the growth of plants, N. M. TULAIKOV** (*Soil Sci.*, 15 (1923), No. 4, pp. 229-233).—This is a summary of the results of extensive investigations, begun in 1910 at the Bezentschuk Experiment Station and subsequently conducted at Petrograd and finally at the Saratov Experiment Station, on osmosis in soils in its relation to plant growth.

The studies were conducted with black chernozem soil and a clay soil. All minerals were usually added which would favor the maximum crop yield, to 5 kg. of absolutely dry soil. The osmotic pressure was increased by the addition of common salts, including sodium chlorid, sodium sulphate, sodium nitrate, ammonium sulphate, ammonium nitrate, and magnesium chlorid. Growth and yield of wheat, hygroscopic water, total nitrogen and protein content, and the hardness and softness of wheat grain were determined.

The results showed that an increase in osmotic pressure of the soil solution arrested the sprouting of seed to a marked degree and weakened it considerably. All the following phases of growth were also arrested. After the period of blossoming was over and ears were formed, the period of ripening was considerably hastened, and the total period of vegetative growth for plants upon soil with an increased osmotic pressure was usually 6 or 7 days less than in normal soils. With a certain optimum osmotic pressure, the development of the plants reached its maximum. The data also showed that with an increase in osmotic pressure of the soil solution, there was an increase in the yield of tops until a certain optimum was reached, beyond which there was a decrease in yield.

It is concluded that an increase in osmotic pressure of the soil solution up to a certain limit, caused by introducing nutritive salts into the soil, will bring about a greater activity of plants, and that under certain conditions there will be an increase in size, yield of tops, and yield of grain. An increase in osmotic pressure increased the total nitrogen and protein nitrogen content, particularly in wheat grains. It was also shown that the quantity of hard grain is increased with an increase in osmotic pressure and vice versa. Nitrates brought about a greater increase in hardness than sulphates. This is taken to indicate the advisability of noting the nature of constituent salts as well as the influence of the osmotic pressure of the soil solution.

Further data indicated that the osmotic pressure of the soil solution influences the transpiration coefficient of the plants studied. The plants used the soil moisture more economically with an increase in the osmotic pressure.

The studies are being continued with oil-containing plants, such as flax and mustard, and with aromatic plants.

**On the question of obtaining the soil solution, N. M. TULAIKOV and M. S. KUZMIN** (*Soil Sci.*, 15 (1923), No. 4, pp. 235-239, fig. 1).—Studies conducted at the Saratov Experiment Station on methods of obtaining the soil solution, in connection with the studies of osmosis noted above, are reported.

These led to the necessity of developing a special method for obtaining the soil solution in a comparatively large quantity more quickly and accurately than can be done with other methods. For this purpose a method was devised involving an apparatus based upon the exhaustion of the atmosphere within a hollow cylinder, placed within a definite volume of soil. The pressure of the outer atmosphere displaces the solution from the soil into this cylinder as soon as sufficient vacuum has been produced. To obtain sufficient soil



solution with a moisture content of less than 50 per cent saturation and to counteract the molecular forces in the soil, which tend to hold small quantities of moisture, the soil is pressed by means of a common press in addition to the air exhaustion. Tests of this method indicate that it permits extraction from varying quantities of soil and that more soil solution is obtained than by the other methods. Comparatively little time is consumed, and the soil solution obtained is of constant concentration in the consecutive portions. By changing the ratio of water to soil more concentrated solutions are obtained for chemical analysis than by water extracts of the soil.

**The influence of solution volume upon plant growth in relation to reaction change and iron availability in culture solutions,** R. M. BARNETTE and J. W. SHIVE (*Soil Sci.*, 15 (1923), No. 5, pp. 413-425, figs. 3).—Studies conducted at the New Jersey Experiment Stations are reported, the purpose of which was to investigate the effect of different solution volumes upon the growth of young wheat plants in two types of culture solutions. A study was also made of the H-ion concentration changes produced by the action of the plants in the different solution volumes and of the influence of these changes upon the availability of iron supplied to the plants in a soluble and insoluble form.

The results showed that young wheat plants in numbers of not more than three per culture may be used in the Tottingham culture solution in volumes of not less than 1,000 cc. without undue retardation in the rates of growth, if the solutions are renewed at frequent intervals of three days or less with a suitable form of iron supplied in the proper amounts to prevent chlorosis in the plants. On the other hand, in a solution modified by substituting ammonium sulphate for potassium nitrate the growth rate of the plants varied in the order of the solution volumes from the lowest to the highest, the most vigorous growth by far being produced in the 2,000 cc. cultures.

The H-ion concentrations were rapidly decreased by the action of the plants in the Tottingham solution in all stages of development. In the modified solution containing ammonium sulphate the plants increased the H-ion concentration of the solution slightly during the early stages of growth and decreased it during the later stages. This reversal in the direction of reaction change is taken to indicate an important physiological change in the plants with respect to the nitrate and ammonium requirements, involving a change in the absorption rates of the nitrate and ammonium ions.

It is concluded that, other things being equal, the rates of reaction change are determined by the volume of the culture solution in which the plants are grown, and the availability of the iron in the forms used is determined mainly by the reaction of the culture solution, as this is influenced by the action of the plants. A direct correlation was found between the decrease in H-ion concentration of the culture solutions and the appearance of chlorosis in the plants. It was found that only partial control of the H-ion concentration of the solutions in contact with the roots of the growing plants may be accomplished by the use of large volumes of solution accompanied by frequent solution renewal.

**Importance of sediment as a means for plant nutrition and soil improvement,** F. ARNHOLD (*Landw. Jahrb.*, 58 (1923), No. 2, pp. 205-250).—A summary of information and of the results of studies on the physical, chemical, and biological properties of river and sea sludges or sediments is presented, special attention being paid to the value of this material in plant nutrition and soil improvement.

In general, this sediment is a uniform mixture of clayey, fine sandy, limy, and humus particles, which are intimately mixed with organic material of plant



and animal origin. In fresh condition it is a plastic, cohesive, dark-blue sludge, while when settled and stratified it becomes a light-gray earthy material.

This material has been used to advantage at the rate of 25,000 kg. per hectare (22,250 lbs. per acre) on poor soils, particularly light, pervious sand and moor soils. Legumes especially respond to additions of sediment to poor soils, although its use is said to be also profitable on grains, vegetables, and grasses. The mechanical composition of this material varies greatly with its manner of formation, and it has a rather uniform content of mineral matter.

Sea sediment consists chemically mostly of colloidal silica, lime, clay, and humus material, and a small amount of nitrogenous material. River sediment, on the other hand, has a higher content of fine particles, phosphoric acid, and nitrogen, and contains less potash, magnesia, and lime.

These sediments are said to be rich in algae and diatoms. The high contents of lime and silica are said to be especially favorable to bacterial life. The organic residues in the sediments, as well as the alumina, lime, and silica, are said to have a favorable influence on the physical properties of soil, with special reference to absorptive, water-holding, and heat-holding powers.

The high bacterial contents of these sediments have been found to increase their fertilizer value very materially. Both symbiotic and nonsymbiotic nitrogen-fixing bacteria were found to prosper in these materials, as well as sulphur-oxidizing, ammonifying, and nitrifying bacteria.

It was found that important losses of nitrogen from fresh sludge were caused by denitrifying bacteria, but when it was packed and stratified this process practically ceased.

It is concluded that river and sea sludges are valuable to the soil, in that they improve its physical properties and add large amounts of plant nutrients and specific, strongly-active types of soil bacteria.

**Availability of adsorbed phosphorus**, R. C. WILEY and N. E. GORDON (*Soil Sci.*, 15 (1923), No. 5, pp. 371-373, fig. 1).—Studies conducted at the University of Maryland to determine the availability of phosphorus adsorbed by soil colloids similar to colloidal alumina and ferric oxid are briefly reported. Colloidal ferric oxid and alumina were subjected to their maximum adsorption in a 0.05 N solution of potassium acid phosphate, and then washed until the filtrate gave no test for the adsorbed phosphate. On analysis these gels were found to contain about one-third of their original phosphate.

Pot experiments with sweet potato plants using the washed material showed that phosphorus which has been adsorbed by soil colloids and which can not be leached out by water is available as a plant nutrient.

**Variability of nitrates and total nitrogen in soils**, A. L. PRINCE (*Soil Sci.*, 15 (1923), No. 5, pp. 395-405, fig. 1).—Studies conducted at the New Jersey Experiment Stations to determine the number of soil samples required for chemical work in order to secure results representative of an entire plat are reported.

The results are taken to indicate that for chemical determinations such as for total nitrogen, phosphorous, and potash on soil composites, where the accuracy of the analytical method is not extremely delicate and the variability of the soil is not pronounced, 9 or 10 samples covering an area of  $\frac{1}{10}$ -acre and made into a composite would be sufficient. Duplicate or triplicate determinations on such a composite should yield results representative of the area within the limits of the accuracy of the methods. However, when the soil constituents to be determined are changing rapidly under field conditions due to microbiological processes or to the activities of plant growth, and when the method of analysis is sensitive as in the case of nitrates



a much larger number of samples must be employed to secure results that will fairly represent the area. To minimize the amount of work involved in such a process, the individual samples should be composited into several groups and these analyzed separately. It is thought that the means of such determinations would be sufficiently accurate and reliable for most practical purposes.

"Whether a very large or relatively small number of borings should be taken in the sampling of a particular area depends in the first place upon what the experimental data are intended to show. If comparisons are to be made between systems that have wide differences, and it is the purpose to show such differences in an approximate manner, then the number of samples need not be so great. . . . However, where the differences between the systems under comparison are small the change of variation between the samples within one system will be as great as the variability of the systems compared, unless the analytical methods are very delicate."

**Experiments on the reclamation of alkali soils by leaching with water and gypsum**, P. L. HIBBARD (*California Sta. Tech. Paper 9 (1923), pp. 14*).—Studies on the leaching of 5-ft. columns of five different alkali soils from the Kearney vineyard are reported.

The results showed that the removal of all but negligible amounts of alkaline salts from the first 6 ft. or more of a heavily impregnated soil will require many months of leaching. Soluble matter not carried below the 6-ft. level by leaching was found to return toward the surface with the capillary water. Most of the soluble matter could be leached out by water alone, but gypsum was valuable as a flocculant to increase the rate of leaching. The anions chlorid, nitrate, sulphate, carbonate, and bicarbonate were leached out in the order given.

Leaching was found to remove desirable plant nutrients as well as undesirable salts, so that a soil which has been leached for a long time is liable to be very unproductive for some years, or until available nutrients have been accumulated again by suitable agricultural practice. The removal of more than 0.5 per cent of sodium carbonate from a soil was a very slow process because of the high degree of deflocculation produced by the alkalinity and because such a concentration of alkaline salts is much greater than can be neutralized by the gypsum in an equal volume of a saturated solution of gypsum.

It is concluded that rates of percolation through soils may be very much more rapid in the field than in constricted columns of soil, and that cognizance of this difference must be taken in the application of the results of laboratory experiments.

**Mathematical expression of the influence of fertilizing elements in the soil**, H. LAGATU (*Ann. École Natl. Agr. Montpellier, n. ser., 17 (1922), No. 4, pp. 270-279, fig. 1*).—This is a mathematical analysis of the influence on the growth of vegetation of such fertility factors as moisture, absorption, availability of nutrients, and the addition of fertilizers.

**Note on the permanent manurial plats, Coimbatore**, R. V. NORRIS (*India Dept. Agr. Mem., Chem. Ser., 6 (1923), No. 8, pp. 245-254, pls. 8*).—The progress results of manurial studies begun in September, 1909, on the Central Farm at the Coimbatore Agricultural College are summarized in this report. During the 13-year period 36 crops have been grown on the 10 different plats. Eight of the plats have received mineral fertilizers in different combinations, while the other two have been treated with cattle manure. The original soils showed a low content of organic matter and a marked deficiency in nitrogen and



available phosphoric acid, while a considerable quantity of potash was present in available form. The plats have been subjected to intensive cultivation, and irrigation has been given as required.

In the early years of the experiment the plats responded to both nitrogen and phosphoric-acid fertilization. The phosphate was more rapidly exhausted than the nitrogen and has become a limiting factor, so that the addition of nitrogen alone produces but small crop increases, while the effect of phosphate becomes more marked each year. Additions of potash have not had any consistent effect in the case of wheat, but have materially increased the yield of rabi both in grain and straw, although chemical analyses showed that the soil was already well supplied with available potash. The percentage of nitrogen or potash in the grain has not been increased by the addition of either or both of these substances to the soil.

The percentage of phosphate in both grain and straw has been found to vary with the amount of phosphate available, the average difference in the case of wheat between the phosphate and nonphosphate plats being 60 per cent in the grain and 122 per cent in the straw. The addition of phosphate has also enabled the grain to assimilate a further supply of potash, although the difference in this case is not nearly so marked. The proportion of grain to straw has been but little influenced by the addition of nitrogen or potash, but has been raised by the application of phosphate.

**" Ammo-Phos: "** Its effects upon seed germination and plant growth, D. G. COE (*New Jersey Stas. Bul.* 375 (1923), pp. 5-102, figs. 33).—Greenhouse studies and field experiments with a high-grade chemical fertilizer called Ammo-Phos, containing 13 per cent of ammonia and 48 per cent of phosphoric acid, are reported. Ammo-Phos is prepared from ground pebble rock phosphate by the sulphuric acid process, and the freed phosphoric acid, together with all excess sulphuric acid, is neutralized with ammonia gas to form a mixture of monoammonium phosphate and ammonium sulphate.

The general purpose was to study the effect of Ammo-Phos and other fertilizer location relative to the seed at the time of planting upon subsequent seed germination and plant growth. Diffusion studies were conducted and osmotic pressures of the soil solution correlated with the germination for different rainfall conditions. Actual field tests of seeding machines with several adjustments of their fertilizer attachments were also made.

The results showed that direct contact of fertilizers with seed in the drill row or hill retards germination, the injury increasing progressively with the amount of fertilizer applications. The osmotic pressure of the soil solution also increased progressively with the amount of fertilizer applications. Concentration appeared to be more harmful to germination than acidity, and acidity was more toxic to growth than to germination. Soaking seeds in distilled water raised their limit of tolerance toward germination injury by fertilizers.

The limits of tolerance to the common complete fertilizer mixtures in corn germination under dry weather field conditions applied in the row in direct contact with the kernels showed that Ammo-Phos is less injurious than sodium nitrate and ammonium sulphate mixtures and more injurious than organic mixtures. Under similar conditions the limits of tolerance for the ingredients alone showed that Ammo-Phos was second only to sodium nitrate in its injurious action.

Under greenhouse conditions in the germination of corn, sodium nitrate alone was more toxic than either Ammo-Phos or ammonium sulphate alone. Ammonium nitrate was less toxic than sodium nitrate but more toxic than Ammo-Phos, and potassium chlorid was more injurious than potassium sulphate.



In the germination of cotton the injury from a complete mixture containing sodium nitrate appeared to be less than from mixtures containing ammonium sulphate or Ammo-Phos, while acid phosphate alone showed considerable toxicity. Wheat, buckwheat, and soy beans were injured in germination similarly to corn for the relative order of toxicity of the various fertilizer mixtures. Potato germination was strongly inhibited by 378 lbs. per acre in the row of a mixture of Ammo-Phos and potassium chlorid.

Rainfall during the germination period varied the injury greatly, but generally lessened the burning action of the fertilizer. The greater the moisture content in a given soil and the heavier the soil type the larger was the amount of fertilizer required to injure germination.

Vertical diffusion of fertilizers in the soil was found to be rapid, but horizontal diffusion was very slow. Within certain limits and for a given soil type and moisture content, horizontal diffusion of a particular salt increased with the application per acre and the lightness of the soil type.

All direct-contact fertilizer applications depressed the initial growth of plants, ammonium salts appearing superior to nitrate salts in this respect. Corn was the most resistant crop, followed in order by buckwheat, wheat, oats, and barley. Cotton, Canada field peas, clover, radishes, carrots, and lettuce were very sensitive to fertilizer injury.

Location of the fertilizer above the seed with varying intervals of soil separation proved to be worthless in dry seasons. Rainfall, immediately after planting with the fertilizer located directly above the seed, leached the salts down around the seed with more or less injury to their germination, depending upon the soil type, the rate of fertilizer application, and the amount of rainfall. A constant concentration of the soil solution surrounding corn kernels existed when the fertilizer applications were made above during a dry season and also when the pots were capillary watered. Rain and surface watering increased the osmotic pressure.

Location of the fertilizer directly below the seed with varying intervals of soil separation produced quick results. High applications near the seed caused germination injury during a dry season or under conditions of capillary watering. In rainy seasons and with surface watering, the upward movement of fertilizers around the seed was lessened, resulting in normal germination. Applications of fertilizers in narrow strips of considerable thickness below the seed were more injurious than wide strips of small thickness. The rate of fertilizer application, its spread, the distance below the seed, soil type, and rainfall conditions were all found to influence the degree of restriction of root development.

Side locations of fertilizers were found to be the best, although increasing the interval of soil separation between the seed and the fertilizer delayed the benefits progressively within certain limits. Potatoes gave the best results with side locations of the fertilizer in a horizontal plane slightly below the seed. Corn did well with side locations in the same plane as the kernels. The correct horizontal plane appeared to be related to the spread of the roots, each crop requiring a certain plane and interval of soil separation for best results. The adjustment of potato planters relative to their fertilizer distribution was found to vary the harvest results, the side-lower-plane adjustment giving the best results.

A study of the phosphates in the island sugar lands, W. T. McGEORGE (*Hawaii. Sugar Planters' Sta., Agr. and Chem. Bul. 47 (1923), pp. 51, figs. 2*).—The results of studies of samples of soil collected from a number of experimental areas on different islands of the Hawaiian group to determine the



relation between the chemical composition and response to phosphate manuring, and the relations of mechanical composition, forms of silica and lime, and soil reaction to availability of phosphates, are reported. The nature of organic phosphates was also studied.

The results in general indicated a low availability of phosphoric acid in Hawaiian soils and a strong feeding power of sugar cane for phosphates. Basic phosphates of aluminum and iron were found to predominate in these soils. Smaller amounts of calcium, magnesium, and organic phosphates were also present, together with an apparently small amount of phosphates combined with manganese and titanium. The presence of aluminum and iron phosphates in large excess was more especially typical of the acid soils and least typical of soils containing large amounts of lime and having pH values of from 7 to 8. An appreciable amount of organic phosphate was present in the acid soils or in those containing only small amounts of soluble lime salts. This is considered to be probably a factor in the low availability of phosphates in the acid types of soil.

Studies of the comparative value of the chemical determination of phosphoric acid in these soils indicated that a knowledge of the total phosphoric acid is highly essential, that a knowledge of the phosphoric acid soluble in strong nitric acid is less essential, and that a knowledge of the phosphoric acid soluble in strong hydrochloric acid is of little value. Of the weak acid solvents, citric acid was found to be of considerable value in determining phosphate availability, especially when supported by a knowledge of past performances of the soil type under consideration.

Fertilizer experiments on areas, the soils of which contained 0.004 per cent or more of phosphoric acid soluble in 1 per cent citric acid, rarely showed a response to phosphoric acid. Size of soil particles appeared to have no influence on the relative availability of phosphoric acid in Hawaiian soils. There appeared to be a definite relation between the availability of silica and the response to phosphatic fertilization. Those soils giving no response were almost universally well supplied with easily decomposable silicates. Four per cent hydrochloric acid was a better solvent for these forms of silica than 1 per cent citric acid, although the latter gave some indication.

The soils in which the phosphoric acid was of low availability were highly acid, and those in which it was of high availability were only slightly acid or alkaline. There was a close relation between the availability of phosphoric acid and the lime content of the soil, especially with reference to the more soluble forms. That phosphoric acid which was soluble in water saturated with carbon dioxide appeared to be most valuable. Lime was also a factor in the assimilation of phosphoric acid by cane, since the phosphate content of cane juices was higher in cane grown on soils containing large amounts of lime.

On the basis of the above results, it is concluded that an island plantation soil containing 0.0025 per cent or less of phosphoric acid soluble in 1 per cent citric acid, having an acidity of pH 5.5 or less, and having a relatively insoluble lime content and a low soluble silica content, will, with rare exceptions, respond to phosphate fertilization when planted to sugar cane.

Phosphate fertilization experiments on four of the islands indicated that out of the total of 47 experiments 33 showed no response to phosphates, and of those responding the majority did so only slightly. It is concluded that in many of these fields phosphate fertilizers might be left out of the fertilization program without affecting the yields. An interpretation of the data on the assimilation of phosphoric acid by cane is taken to indicate that the feed-



ing power is of such strength as to warrant a more thorough trial of phosphate rock on cane fields.

Descriptions of chemical methods of determining phosphoric acid are appended.

**Reversion of acid phosphate in acid soils**, T. D. HALL and J. C. VOGEL (*Soil Sci.*, 15 (1923), No. 5, pp. 367-369).—Studies conducted at the Potchefstroom Experiment Station in South Africa to determine the fate of superphosphate when applied to acid soils with and without the addition of limestone are reported. A series of mixtures of samples of acid brown sandy loam and acid dark gray peaty soil with superphosphate and limestone were made, allowed to stand for a month, and then analyzed for soluble phosphoric acid.

The results showed that there was no actual benefit, as far as the availability of the superphosphate was concerned, to be had from mixing limestone with superphosphate or applying them to the soil separately even in different order. With both soils the limed mixtures lost slightly more than the unlimed mixtures, with one exception. The mixtures limed with the coarser grade of limestone seemed to revert the most. The results are taken to indicate that the different rates of reversion are not due to a greater proportion of soluble iron in one case.

**Action of phosphoric acid fertilization**, O. NOLTE (*Mitt. Deut. Landw. Gesell.*, 38 (1923), No. 19, pp. 259-264).—A summary is given of the results of several studies of phosphoric acid fertilization conducted principally in Europe, and several theories as to the proper use and importance of such fertilization are briefly reviewed.

It is concluded that the requirements of the soil for phosphoric acid where no phosphatic fertilization is practiced will increase in accordance with the original supply of phosphoric acid in the soil and its availability and the rate of its assimilation by crops. The problem of phosphatic fertilization thus resolves itself virtually into a consideration of the needs of each individual farm.

The results of the long-time fertilizer experiments with and without phosphatic fertilization at the Rothamsted Experimental Station are considered to be most striking evidence of the importance of phosphatic fertilization where it is actually needed. It is stated that owing to the constant widespread use of stable manure in Germany the soils of that country are not likely to become so extremely deficient in phosphoric acid as the unfertilized soils at Rothamsted. With this in view, it is recommended that each German landowner make a general determination of the response of different crops to phosphatic fertilization on his soil before adopting any set procedure.

**The phosphoric acid question**, F. HONCAMP (*Ztschr. Angew. Chem.*, 36 (1923), No. 55, pp. 381-386).—This is a critical discussion of the phosphoric acid question, with particular reference to the fertilization theories of Aereboe and Wrangell.

**Phosphate in Permian Red Beds of Oklahoma and Texas**, A. C. SHEAD (*Chem. Age [New York]*, 31 (1923), No. 7, pp. 319, 320).—In a contribution from the Oklahoma Geological Survey the results of investigations into the nature and extent of these beds are briefly summarized. These are taken to indicate that the Permian Red Beds of Oklahoma are phosphatic in nature and afford a possible field of operations. The analyses indicate that this phosphate is of a quality comparable to South Carolina rock.

**Solubility of limestones as related to their physical properties**, M. F. MORGAN and R. M. SALTER (*Soil Sci.*, 15 (1923), No. 4, pp. 293-305, figs. 3).—Studies conducted at the Ohio State University on 12 limestone materials



covering a wide variation in physical and chemical properties, to determine the factors influencing their rates of solubility when applied to acid soils, are reported.

No apparent relationship existed between any physical properties determined and the rate of solubility. The limestones used varied greatly in their rates of solubility, but showed practically the same order of solubility by all of the methods employed. The differences in solubility of limestones containing appreciable amounts of magnesium carbonate were explained by the lower solubility of dolomite in a solution having a H-ion concentration comparable to that prevailing in an acid soil. The differences in solubility of limestones containing no appreciable amount of magnesium carbonate could not be explained on this basis. The fineness to which dolomitic limestones were ground was of greater relative importance than was the case with high-calcium stones.

**A comparison of magnesian and nonmagnesian limestone in some 5-year rotations,** J. G. LIPMAN, A. W. BLAIR, H. C. McLEAN, and A. L. PRINCE (*Soil Sci.*, 15 (1923), No. 4, pp. 307-328).—The results of a 15-year experiment at the New Jersey Experiment Stations, involving the use of magnesian and non-magnesian limestone in three different amounts in connection with four different 5-year crop rotations (*E. S. R.*, 43, p. 128) are summarized.

With few exceptions the lime-treated plats showed substantial increases in crop yield over the check plats. Of the crops used in the various rotations, the legumes showed a greater response to the lime treatments than the non-legumes, although the latter usually showed some response. In most cases a 1-ton application gave some increase over a  $\frac{1}{2}$ -ton application, but, in a number of cases at least, this increase was not sufficient to justify the additional expense. In the majority of cases the 2-ton application gave but a slight increase in yield over the 1-ton application, thus indicating that the 2-ton application is excessive from the standpoint of economy.

In a few cases there were indications of crop injury from the use of 4,000 lbs. of magnesian limestone per acre. Aside from this the two forms of limestone gave quite similar results, although for the entire period there was a slight difference in favor of the magnesian limestone. Very little more nitrogen was recovered from the crop with the 2-ton application than with the 1-ton. In this case, also, the magnesian limestone seemed to show a slight advantage over the other form.

The legume crops on the limed plats showed a higher percentage of nitrogen in the dry matter than the nonlegume crops. In some cases the difference was very pronounced. This is taken to indicate an improvement in the quality of the crop as well as an increase in the quantity.

Evidence was obtained that the magnesian limestone favors nitrogen fixation more than the calcium limestone. There was a decrease in the lime requirement of the soil, as determined by the Veitch method, with increase in the amount of lime applied. The 2-ton application left the soil near the neutral point at the end of each 5-year period. With 1 ton the lime requirement was in most cases between 300 and 600 lbs., and with  $\frac{1}{2}$  ton from 600 to 1,200 lbs. per acre. In most cases the check plats indicated a requirement of from 1,200 to 1,500 lbs. per acre. The H-ion concentration decreased gradually as the lime applications were increased, and the results indicate that this method may, in some circumstances, be used for the determination of the lime requirement.

The nitrogen content of the soil remained fairly constant during the last 10 years of the period, with a slight upward tendency. This is taken to indicate that the systems of cropping practiced in this experiment did not deplete the soil of nitrogen and organic matter, and that undoubtedly the legume crops



are a factor in maintaining the soil fertility. In general, there was no definite indication that lime tended to cause an abnormally rapid disappearance of nitrogen and organic matter from the soil. The results in general of this study are taken to indicate that it is not necessary to fully satisfy the lime requirement of the soil, as commonly expressed, in order to get good results with most farm crops.

**Fertilization of crops with sulphur**, O. NOLTE and R. LEONHARDS (*Mitt. Deut. Landw. Gesell.*, 38 (1923), No. 18, pp. 248, 249).—A brief summary of data from laboratory and field experiments from different sources on the fertilizing influence of sulphur on crops on different soils indicates that here and there sulphur caused marked increases in crop yield, but that in the majority of cases it had no effect. Doubt is expressed as to the general need for sulphur fertilization on German soils.

**Comparison of "active" aluminum and H-ion concentrations of widely separated acid soils**, P. S. BURGESS (*Soil Sci.*, 15 (1923), No. 5, pp. 407-412).—Studies conducted at the Rhode Island Experiment Station to ascertain roughly the extent of geographical distribution of so-called active soil aluminum and to determine whether or not a correlation exists between it and soil reaction, irrespective of locality, are reported. About 25 samples of representative acid mineral soils from as many widely separated sections of the United States, including the Territory of Hawaii, were used in the studies. Active aluminum determinations, H-ion determinations by the electrometric method, loss on ignition, and total nitrogen determinations were made.

Considered from the viewpoint of a mass average, a direct correlation was found to exist between H-ion concentration and active aluminum in acid soils, although there were several individual exceptions. The more acid soils, with pH values of from 4 to 5, contained an average of 388 parts per million of active alumina, while the less acid group, with pH values of from 5 to 5.8, contained an average of but 26 parts per million. The exceptions are of interest in that a high content of active aluminum and low acidity may at times explain a lack of response to liming.

No definite correlation was noted between active aluminum and the percentages of either organic matter, nitrogen, clay, or silt, although often the soils rich in organic materials and nitrogen yielded the larger amounts of soluble aluminum. A causal relationship appeared to exist between rainfall and active aluminum.

It is concluded that soil genesis is largely responsible for the differences recorded in these results. With the exception of the Hawaiian laterites, the glaciated soils carried much larger amounts of active aluminum than did the others, the older soils exceeding the more recent in this respect.

**Standard fertilizer formulas and their use**, G. S. FRAPS (*Texas Sta. Circ.* 31 (1923), pp. 3-7).—This is a statement with respect to the adoption of 11 standard formulas for mixed fertilizers and suggestions for their use, particularly in Texas.

[**Chemical terms used on fertilizer materials**], compiled by W. J. GASCOYNE, JR. (In *Chemical Terms Used on Fertilizer Materials, Feeding Stuffs, Fats, and Oils Explained*. Baltimore: Gascoyne & Co., Inc., 1922, pp. 3-22).—A list of chemical terms used in connection with fertilizers and fertilizer materials is presented and discussed.

**The American fertilizer handbook, 1923** (Philadelphia: Ware Bros., 1923, pp. [480], illus.).—This number of this handbook contains the usual standard references and directory of the commercial fertilizer industry and allied trades, together with a number of special articles on related subjects.



## AGRICULTURAL BOTANY.

**Effect of salts on the intake of inorganic elements and on the buffer system of the plant,** D. R. HOAGLAND and J. C. MARTIN (*California Sta. Tech. Paper* 8 (1923), pp. 26, figs. 5).—The results are given of a study on the effect of an alkali soil or solution on the chemical system of the plant.

It was found that sodium chlorid and sodium sulphate, when added to a culture solution, caused marked alterations in the absorption of inorganic elements and in the composition of the barley plant. The cations were particularly involved, the sodium salts tending to decrease the absorption of calcium, magnesium, and potassium. It was found that when sodium chlorid is used, sodium and chlorin may be absorbed and stored by different plants in relatively large quantities. In the case of sodium sulphate, the sulphate ion is removed from solution less rapidly than the chlorin ion. It was concluded from the experiments that no definite alkali tolerances for different plants can be established because of the modifying influences of climate and season and other environmental conditions.

Observations were made on the effect of salts on the reaction and buffer systems of barley, peas, and pumpkins. Rapid and extreme changes in the reaction of the sap expressed from the roots are said to be caused by the addition of sodium bicarbonate to the culture solution. The buffer effect of the sap expressed from the stems and leaves was found greater than that of the sap expressed from the roots and was less subject to change of reaction. Calcium chlorid produced appreciable changes in the reaction and buffer effect of the plant juices. Barley and pumpkins were influenced in opposite directions. Neutral sodium salts caused slight changes in reaction and titration values. Sodium nitrate in the concentration employed increased the alkalinity of the expressed root sap, with accompanying injury similar to though less extensive than that induced by sodium bicarbonate.

**The localization of manganese in higher plants,** G. BERTRAND and M. ROSENBLATT (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 22, pp. 1118–1120).—In studies confirming the conclusion previously noted (E. S. R., 50, p. 21) and employing *Nicotiana rustica* and *Lilium lancefolium rubrum*, it was shown that localizations occur. The passive woody material is remarkably poor in manganese, though seeds show a high percentage, supposedly for the use of the plantlet.

**Variations in the manganese content of leaves with age,** G. BERTRAND and M. ROSENBLATT (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 7, pp. 491–493).—Certain plants are arranged in four groups with regard to their behavior in storing manganese locally, and the behavior of these groups and of individual plants is briefly discussed. The manganese content of the leaves is generally greater in the earlier part of their development.

**Action of soluble lead salts on plants,** E. BONNET (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 7, pp. 488–491).—Detailed results are given of experiments testing the effects of lead salts at different concentrations on the growth of economic plants, as carried out in 1914 and 1921 under similar conditions with concordant results.

The stem growth is in general checked strongly, the root growth much less, by lead salt solutions.

**Corrosive action of roots on marble,** E. CHEMIN (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 21, pp. 1014–1016).—From experimentation described it is concluded that none of the plants used excrete in sensible quantity any acid capable of corroding polished marble other than carbonic acid, which is capable of producing this effect.

**Comparative structure in leaves of the same ages but different sizes, F. OBATON** (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 22, pp. 1113-1116).—Comparative leaf structure studies, here outlined, as applied to *Acer platanoides*, *Ligustrum japonicum*, *Celtis australis*, *Ulmus campestris*, *Carpinus betulus*, and *Fagus silvatica*, are tabulated with discussion.

It is noted, from comparisons of leaves, large and small, of the same age and on the same branch, that the histological elements in these cases are of approximately the same size in the parenchymatous regions of the lamina, and that they are almost alike as regards the composition of the veinings in portions which are physiologically comparable.

**Biochemical tests of seed values, A. NĚMEC and F. DUCHOŇ** (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 20, pp. 933-935).—In studies of resting seeds, by NĚmec, it was noted that the activity of the diastase glycerophosphatase varied as the seed altered with age; and both authors have studied the relations existing between the age and the diastatic activity of maize seeds, with a view to ascertaining the agricultural value of the corresponding knowledge. The results are tabulated for glycerophosphatase, lipodiatase, urease, phyto-proteases, amylase, and catalase.

It is apparent that the activity of the hydrolyzing diastases may outlast the germinability of the seed. It is different with catalase, loss of effectiveness of which appears closely related to the decrease and loss of vitality of the organism. The small amount of oxygen separated may arise from the mineral catalyzers or from the colloidal substances of the seed.

It appears probable that the activity of catalase, measured under comparable conditions in volume of oxygen separated, might furnish a convenient and rapid means to estimate the agricultural value of seeds; only the limits of practical control for this vital indicator remain to be fixed.

**The formation of aleurone grains in the endosperm of Ricinus, P. DANGEARD** (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 19, pp. 857-859, figs. 9).—Phases of study previously indicated (*E. S. R.*, 48, p. 328) are dwelt upon with extension of data and conclusions. It is stated that the formation of aleurone grains, as here briefly noted, is really a particular case of a more general phenomenon, the evolution of the vacuolar system as understood by P. A. Dangeard (*E. S. R.*, 45, p. 30).

**Development of aleurone grains in seeds of Ricinus during germination, P. DANGEARD** (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 25, pp. 1401-1403, figs. 9).—During germination the seeds of *Ricinus* show, as to the vacuolar system, a series of stages, here outlined, comparable (though in reversed order) with those observed to occur during the maturation of the seeds.

**The origin of vacuoles in aleurone during germination in the Graminaeae, P. DANGEARD** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 5, pp. 319-321, figs. 12).—Noting the fact recorded above that in maritime pine and in *Ricinus* vacuoles arise in connection with aleurone grains preexistent in the seed, and referring to the claim made by Mottier (*E. S. R.*, 47, p. 223) that aleurone grains in maize arise from primordia comparable with those of leucoplasts and chloroplasts, the author claims to have shown that aleurone grains represent the elements of the vacuome in *Pinus* and in *Ricinus*. Observations on legumes favor the same view. It is regarded as certain that in case of plantlets vacuoles arise only in the aleurone during germination. This is regarded as a phenomenon of fundamental significance in connection with the development of the vacuolar system.

**The significance of the canaliculi of Holmgren, A. GUILLIERMOND and G. MANGENOT** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 7, pp. 485-488,



*figs. 11*).—Cytological study applied to barley roots leads to the conclusion that the canaliculi of Holmgren are not artifacts, as has been claimed, but that they represent phases of the vacuolar system.

**The nature of the spherome in vegetable cells**, P. A. DANGEARD (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 22, pp. 1038–1041).—Reply is made to statements by Guilliermond, previously noted (*E. S. R.*, 50, p. 125.)

**The rôle of the chondriome in the formation of substances in plants**, J. POLITIS (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 2, pp. 98–100).—Studies have been carried out with certain Labiatae and Geraniaceae. In hairs on the former, it was noted that at a certain stage mitochondria were present and that from these arose tannic compounds, the quantity increasing with the age of these structures and the appearance of essential oils, and the contents of the vacuoles becoming more refractive at the same time. In the secretory hairs of Pelargonium, the formation of a tannic compound could be followed with ease. Other demonstrations are outlined.

**The structure of the vegetable cell in relation to the chondriome theory**, P. A. DANGEARD (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 3, pp. 120–123).—The classification of cytoplasmic elements, previously used (*E. S. R.*, 45, p. 30), is claimed to be applicable to all groups of the vegetable kingdom. The chondriome theory is held to be equally applicable to all animal groups.

**Cytological study of the sporangium in ferns**, L. EMBERGER (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 26, pp. 1485–1487, *fig. 1*).—In pursuance of the lines of investigation previously noted (*E. S. R.*, 45, pp. 30, 31), the author attempts to show that epidermal cells in the ferns must undergo profound modifications in order to form a sporangium, such change consisting in rejuvenescence; also that a chloroplast, even though highly differentiated, may revert to the mitochondrial stage in the period of functional repose. The experimentation also disaffirms the theory of a continuity of the germ plasma.

**The biology of alkaloids in belladonna**, J. RIPERT (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 20, pp. 928–930).—The author has been able to show that in the nightshade, anatomical corresponds to chemical dorsiventrality, and that annular decortication at the crown causes increase of alkaloids in the leaves and decrease in the roots; also supposedly to show that in detached branches placed in distilled water in light, whether supplied with air or pure oxygen, the alkaloids are waste products, decreasing or disappearing as stored nutrients become utilized.

Recently, attention has been given to the question regarding the behavior of the alkaloid in the (partial or total) development of belladonna in darkness. Leaves (which become yellowed) and stems both increased in content of both the alkaloid and albuminoid nitrogen.

Etiolated leaves and stems corresponding, exposed to light for 13 days, showed partial recovery and a corresponding progressive diminution in alkaloid content, the roots not showing a corresponding increase. Whether the alkaloids were used in the plant or eliminated by some process as yet unknown, does not appear. Studies bearing on this question are in progress.

**Influence of solar radiation on the culture of belladonna and the formation of alkaloids in the leaves**, A. GORI and H. DELUARD (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 3, pp. 188–190).—Direct sunlight favors leaf production in belladonna. Leaves produced in sunlight contain no more dry material by weight than do ordinary leaves, but they contain a greater proportion of alkaloids.

**Formation of red pigment in *Beta vulgaris* by the oxidation of chromogens,** A. KOZŁOWSKI (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 19, pp. 855-857).—After isolating chromogens from white sugar beets by a method which is described, the author obtained from the chromogens by oxidation a pigment presenting the same spectroscopic characters as did the pigment extracted from red beet varieties, and reacting in the same ways to acids and alkalis. The spectroscopic and other similarity of the products obtained to these pigments in red beets are considered to favor the view that in nature the transformation of white substance into anthocyanins is due to the same succession of chemical phenomena. The chromogens here studied show properties much resembling those of saponins.

**Transformation of color due to oxidation,** ST. JONESCO (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 21, pp. 1006-1009).—Having shown, as a phase of work previously noted (*E. S. R.*, 50, p. 127), that the mode of formation of anthocyanin in flowers of *Cobaea scandens* is not a particular case, but that it belongs among the general phenomena of reddening in plants, the author has dealt in the present note with the transformation, by oxidation, of chromogen in colorless flowers of that plant. To this are added accounts of other chromogens or transformable pigments in other plants.

It is maintained, as a result of various observations and experiments, that the appearance of red pigment in plants is due to oxidation and not to reduction.

**The formation of anthocyanic pigments,** R. COMBES (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 4, pp. 240-242).—In work with *Ampelopsis hedera-cea* having in view the conclusions of St. Jonesco, noted above, the author obtained and tested colorants which are discussed. Anthocyanic pigments are not to be considered as sufficiently characterized by their red coloration turning in the presence of alkali. Indispensable tests are indicated, with criticism of claims by different workers which are said to be defective.

**Synthesis of hydrocyanic acid by oxidation of ammonia, carbohydrates, glycerin, or formic aldehyde,** R. FOSSE (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 25, pp. 1370-1372).—An outline is given of processes, ascertained or inferred, in the synthesis of hydrocyanic acid in plants.

**Helianthus grafts,** H. COLIN (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 19, pp. 852-854).—The author has been able to show that in grafts between *H. annuus* and *H. tuberosus* the sap in the neighborhood of the graft union, even within the pad, is invariably dextrorotatory in the former symbiont and levorotatory in the latter. These facts indicate, presumably, that even in passing from one symbiont to another, which the hydrocarbons are herein claimed to do (*E. S. R.*, 39, p. 645), they undergo appropriate transformations in conformity with the physiology of each.

Recently the author has made successful grafts, suppressing on the stocks both leaves and buds. Deprived of its assimilatory apparatus and forced to depend upon the sunflower symbiont, the artichoke gave tubers filled with inulin. Inferences from this and related facts are discussed.

**Recent studies on *Helianthus* grafts,** L. DANIEL (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 26, pp. 1482-1485).—When sunflower (*H. annuus*), which is annual and forms no inulin, is grafted on another species of *Helianthus* which elaborates inulin and which perennates by means of its tubers, tuberization is effected but varies according to the height of the graft and to conditions, inulin being arrested at the graft union. It has been claimed that when the height of the stock is as much as 0.8 meter (31.5 in.) the stock forms inulin exclusively or almost so from dextrorotatory material furnished by the sunflower. The author claims that his studies previously noted (*E. S. R.*, 47, p.



339) show these conclusions to be not fully warranted, and that more recent study, using reciprocal grafting, would indicate a lack of autonomy in the stock whether it be *H. multiflorus* or *H. tuberosus*.

**Studies on the biology of *Monotropa***, COSTANTIN and DUFOUR (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 21, pp. 957-959).—The studies of Rayner on symbiosis in *Calluna vulgaris* (E. S. R., 33, p. 221), and the discovery in the Forest of Fontainebleau of large quantities of *M. hypopitys*, a species of the same family, led the authors to make a study of *Monotropa*, utilizing methods found suitable to the study of a fungus on *Goodyera repens* (E. S. R., 47, p. 426). This study has resulted in the isolation of a fungus of striking characters which are partly described, the fungus being provisionally named *Monotropomyces nigrescens*.

**The problem of geotropism**, H. RICOME (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 21, pp. 1009-1012).—Discussion is given of the operation and effectiveness of factors influencing behavior in geotropism.

**Orientation of stems**, H. RICOME (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 8, pp. 424-426).—Observations and suggestions are offered regarding the behavior, as regards orientation, of growing shoots of different plants, with some reference to water supply and other possible factors.

**The influence of orientation in setting out young trees**, MARTIN-ZÉDÉ (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 1, pp. 61-62).—Care in resetting young trees in the same position with reference to the points of the compass resulted in a reduction of losses, by dying, from 50 to from 6 to 8 per cent. The supposedly significant factors are discussed.

**The mechanism of orientation of leaves**, E. ZAEPFFEL (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 2, pp. 119, 120).—Deformation in a petiole or part thereof, with resulting leaf orientation, is produced by unequal distribution of water in the two halves of the petiole, due to determining factors dealt with in the article previously noted (E. S. R., 50, p. 127.)

**Experimental acceleration of development in conducting apparatus**, A. DAUPHINÉ (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 22, pp. 1111-1113, figs. 3).—The growth effects obtained by sectioning roots of lupines are described.

**Inventories of seeds and plants imported by the Office of Foreign Seed and Plant Introduction during the period from April 1, 1921, to March 31, 1922** (U. S. Dept. Agr., Bur. Plant Indus. Inventories Nos. 67 (1923), pp. IV+100, pls. 6, fig. 1; 68, pp. III+65, pls. 4; 69, pp. III+41, pls. 6, fig. 1; 70, pp. III+37, pls. 4).—Economic notes are given of more than 2,000 introductions of seeds and plants secured from various sources for trial in the United States.

## GENETICS.

**Morphological studies of chromosomes and nuclei**, O. TAMURA (*Arch. Zellforsch.*, 17 (1923), No. 2, pp. 131-164, figs. 6).—The author has endeavored to study the structure of the nuclear membrane, chromatin, nucleolus, linin, and nuclear plasm of the cells from the following materials: Larvae of tritons; testicles of tritons. *Salamandra maculosa*, *Cryptobranchus japonicus*, and *Ascaris megalocephala bivalens*; eggs of *A. megalocephala bivalens*; salivary glands of *Chironomus* larvae; and portions of the bulb of *Allium cepa*. The nucleus has been found to consist of two essential substances, the one being protoplasmic and chromatic, forming a network throughout the nucleus in which the other substance flows, it being a partial liquid. The nuclear membrane, chromatin, linin, and nucleolus are composed of the same material, which is the first-mentioned substance.

**A peculiar mode of inheritance and its cytological explanation, Ö. WINGE** (*Jour. Genetics*, 12 (1922), No. 2, pp. 137-144, pl. 1).—Previously noted (E. S. R., 47, p. 667).

**X-ray and the sex chromosomes, J. W. MAVOR** (*Science*, 57 (1923), No. 1478, pp. 503, 504).—Two additional experiments in the production of nondisjunction in *Drosophila* by X-rays have been carried on with results similar to those reported for previous experiments (E. S. R., 47, p. 67). Improved technique (not fully described) has involved the use as X-rayed mothers of heterozygous flies resulting from crossing white-eyed long-winged females with eosin-eyed miniature-winged males. In one experiment 1,557 regular sons, 42 exceptional sons, 1,771 regular daughters, and 8 exceptional daughters were produced by 76 X-rayed females, and 7,531 regular sons, 5 exceptional sons, 7,711 regular daughters, and 1 exceptional daughter were produced by 79 control females.

In the second experiment all the 26 X-rayed and 19 control females were daughters of 1 white-eyed female mated to 2 eosin-eyed miniature-winged males. The X-rayed females produced 1,934 regular sons, 42 exceptional sons, 2,173 regular daughters, and 8 exceptional daughters, and the control females produced 5,109 regular sons, 3 exceptional sons, 4,985 regular daughters, and 1 exceptional daughter. Seven of the 8 exceptional daughters produced by X-rayed mothers in each experiment were fertile and continued to produce exceptional offspring. Statistical treatment of the differences between the exceptions produced by the treated and control stock indicated that the differences were from 9.4 to 49.8 times their probable error.

"The data now accumulated make it reasonably certain that X-rays not only cause nondisjunction, but that the exceptional daughters of X-rayed mothers are in most cases fertile and themselves produce exceptional offspring."

The exceptional daughters were found to be of two kinds, those formed by equational and reductional nondisjunction. Four from the first experiment were homozygous for both sex-linked characters and, therefore, of the first group, and the other 3, as well as 7 from the second experiment, were heterozygous and, therefore, of the second group. The 2 sterile exceptional daughters were homozygous for one sex-linked character and heterozygous for the other.

"It is clear from the results of the experiments described that X-rays may cause nondisjunction during either the first or the second of the maturation divisions, and that the exceptional condition of the females produced by it, consisting in the possession of two X-chromosomes and one Y-chromosome, is transmitted to a proportion of their offspring. There is, therefore, in this effect of X-rays on the germ cells a very clear case of an external agent which modifies the mechanism of inheritance in such a way that a permanent effect is produced on the germ cells."

**Investigations in intersexuality, II, R. GOLDSCHMIDT** (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 29 (1922), No. 3-4, pp. 145-185, figs. 17).—Further experiments have tended to corroborate the theory of intersexuality which was fully discussed in the gipsy moth (*Lymantria dispar*) in a previous paper.<sup>1</sup> To determine the effect of different temperatures on the development of intersexuality, pupa of females were held for periods of from 4 to 8 weeks at temperatures of 1° and 8 to 9° C., and the effect on the characters of the emerging moths studied. The lower temperature practically stopped development, and the pupa were not able to emerge normal even when taken into a warmer place. There seemed to be practically no evidence of the production of intersexuality.

<sup>1</sup> *Ztschr. Induktive Abstam. u. Vererbungslehre*, 23 (1920), pp. XI-XVII + 1-199.



At the higher temperatures development was much retarded, but a considerable amount of intersexuality showed in the moths developing from the pupa held at 8 to 9° for periods of from 4 to 10 weeks as determined by the form of antennae and wing patterns. The degree of intersexuality seemed to depend on the duration of the cold temperature.

**A histological study of the testis in cases of pseudointersexuality and cryptorchism with special reference to the interstitial cells,** H. B. FELL (*Quart. Jour. Expt. Physiol.*, 13 (1923), No. 2, pp. 145-158, pls. 6).—This is the report of a histological study of the testes of two intersexual pigs and inguinal cryptorchids of a rabbit, five 2-year-old colts, and a cat. Micrographs showing the structures in detail are given. The work was carried on at the animal breeding research department of the University of Edinburgh.

**Color inheritance in fowls,** L. C. DUNN (*Jour. Heredity*, 14 (1923), No. 1, pp. 23-32, figs. 4).—Experiments in crossing Light Brahmas and Buff Orpingtons previously noted (E. S. R., 48, p. 165) are reviewed, and additional experiments with reciprocal crosses of Light Brahmas (Columbian pattern) and Black Orpingtons are described. The birds from both crosses were black, but there was much white lacing appearing in the hackles, saddles, and wing bows of the males, resembling Silver Duckwings. The females from Columbian male  $\times$  black female crosses had white lacing on the feathers of the head, neck, and breast as in the Birchen pattern. In the reciprocal cross the females were self-black, with one showing a few red bordered feathers under the lower jaw. Further breeding of the F<sub>1</sub>s made it quite evident that a single dominant factor differentiates black from Columbian coloration.

The following factors and symbols are suggested as influencing the different patterns: E<sup>m</sup> for extension of black to all parts of the plumage, e<sup>m</sup> restriction of black to wings and tail (Buff or Columbian), S for silvered (Columbian, Duckwing, etc.), and s not silvered. The factor S is located in the Z-chromosome.

**Hereditary shortness of thumbs,** J. K. BREITENBECHER (*Jour. Heredity*, 14 (1923), No. 1, pp. 15-22, figs. 5).—The author describes the occurrence of a peculiar short-thumbed condition in some of the offspring of a family during five generations. A woman from which the family descended showed this characteristic, which seems to be due to a dominant nonsex-linked Mendelian factor.

**Naked oats,** T. R. STANTON (*Jour. Heredity*, 14 (1923), No. 4, pp. 177-183, figs. 3).—The characteristics of naked oats are pointed out, with notes on history, varieties, comparative yields, and the inheritance of the naked character.

Most of the lots introduced into the United States have been of the Chinese variety (*Avena nuda chinensis*), from which several new varieties have been developed by crossing with some of the best common varieties. Data cited show that naked oats can not compete with common hulled oats in yield, and they are said to be inferior in storage quality and viability. Studies of the mode of inheritance of the naked character in naked-hulled crosses indicate rather definitely a simple monohybrid segregation in the F<sub>2</sub> of 1 naked, 2 intermediate (with both naked and hulled oats in the same spikelet), and 1 hulled. Securing a multiflorous hulled variety by using naked oats for crossing appears impossible since the many-flowered spikelet and naked kernel or membranous palea have been shown to be linked. For this reason the number of flowers is reduced in all plants which breed true for adherent palea (hulled condition).

**A multiflorous variation in Burt oats,** F. A. COFFMAN and K. S. QUISENBERRY (*Jour. Heredity*, 14 (1923), No. 4, pp. 185-192, figs. 5).—In a study carried on by the U. S. D. A. Office of Cereal Investigations in cooperation with the



Kansas Experiment Station, a plant appearing in a strain of Burt oats, C. I. No. 1921, showed the multiflorous spikelet correlated with the naked (hull-less) condition characteristic of *Avena nuda*. The panicle resembled that of a hulled  $\times$  hull-less  $F_1$  hybrid, but except for this and the spikelet, the characters of the plant did not vary greatly from the average of the parental strain. The appearance of  $F_1$  plants closely approximated that of the original variant and, with the exception of one underdeveloped individual bearing only naked kernels, all of the  $F_2$  plants showed the intermediate form characteristic of the original variant. Since the genetic behavior of this variation is not in agreement with the results of those who have reported on crosses of hulled  $\times$  naked oats, apparently this intermediate multiflorous variation may have resulted from mutation rather than by natural hybridization.

**The production of a marbled vetch variety**, L. BLARINGHEM (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 16, pp. 666-668).—Crossings between varieties of *Vicia faba* show that brown seed color is dominant over gray or green. The variety *V. faba pliniana* shows in the hybrid progeny new characters, marbled or speckled, which persist in a number of the descendants and appear more stable even than the character brown of the ancestor. It is thought that certain marbled bean varieties may be paralleled by similarly marked vetches of commercial interest.

**Inheritance of physiological characters in barley hybrids**, L. BLARINGHEM (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 25, pp. 1396-1398; 175 (1922), No. 4, pp. 230-232).—The  $F_1$  progeny of *Hordeum seocriton*  $\times$  *H. nudum* and of *H. nudum*  $\times$  *H. trifurcatum* are described, and the behavior of  $F_2$  of the latter cross is recorded.

$F_2$  of *H. nudum*  $\times$  *H. trifurcatum* segregated into 123 hooded and 49 awned plants. The 123 hooded plants and the 49 awned plants could be further separated into 2-rowed, intermediate, and 6-rowed individuals in proportions of 48:36:39 and 26:6:17, respectively. Linkage between intermediacy and the presence of hoods is indicated. The compactness of the spikes had a wider spread in the  $F_2$  than in  $F_0$  or  $F_1$ . It is concluded that "if ornamental and superficial characters (awns)" are transmitted nearly according to Mendel's law, the characters essential to the fertility of the spikelets, on the contrary, are directly dependent on the growth factors and, definitively, on the cellular arrangement which is a mosaic.

**Studies on flax hybrids**, L. BLARINGHEM (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 5, pp. 329-331).—In the progeny resulting from crossing a flax having white (ivory-colored) seeds with Moroccan flax, it was found that the brown seed color of the latter was dominant and that the condition ciliated septa was dominant as opposed to naked septa. The results of this work showed also that the apparently homogeneous Moroccan flax gives certain strains which in crossing act as carriers of simple Mendelian characters; also others which act as carriers of complex characters. Crossing with a reactive variety permits the separation of regular lines in a complex. Such a method, combined with that of choice of lines having regular pollen, furnished the conditions for the technique which the author has adopted for the purposes of improvement.

**The relation of the spelt factor in wheat to rachis internode characters**, S. BOSHNAKIAN (*Genetics*, 8 (1923), No. 3, pp. 261-275, figs. 2).—The relation of the spelt character in wheat to density and square-headedness is shown quantitatively in this contribution from Cornell University in cooperation with the Office of Cereal Investigations, U. S. D. A. The material consisted of an  $F_2$  population of a cross between White Spelt (lax) and Dale Gloria (a dense sativum). The inheritance of density, square-headedness, and the spelt character has been discussed earlier (E. S. R., 46, p. 333; 47, p. 738).



Plants of like genotype with respect to the density (*C*) and spelt (*S*) factors congregated within rather definite areas on a correlation table in which one magnitude represented different classes of density, and the other magnitude, various classes of square-headedness. The reasons for this type of segregation appear to be that within both sativum and spelt classes the degree of density depends upon the presence and dose of the *C* factor. The *C* and square-headedness factors remaining constant, whether in homozygous or heterozygous conditions, plants which lack the *S* factor (sativums) are decidedly more dense and more square-headed than those carrying the *S* factor (i. e., spelts); and plants carrying a single dose of the *S* are more dense and more square-headed than plants which carry a double dose of the *S* factor. It is concluded that the spelt factor decidedly interferes with the full expression of the factors for density and those for square-headedness.

### FIELD CROPS.

**Replication in relation to accuracy in comparative crop tests**, R. SUMMERBY (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 5, pp. 192-199, fig. 1).—Experiments were conducted at Macdonald College, Quebec, in 1921, using Alaska wheat and Huron oats on single and replicated plats of different sizes and shapes.

Large plats were found to be more accurate than small plats in all the tests reported. The mean percentage error ranged from 2.31 with wheat plats 0.032 acre (32 by 96 links) in size to as much as 7.86 with oat plats 0.0016 acre (5 by 32 links). An increase in the length of plat had a greater influence on decreasing the error than did an increase in width, and replication was much more effective in reducing the error than was an alteration in either the size or shape of plats. Frequent replication of small plats appeared to be more effective in obtaining a high degree of accuracy than the use of the same area with fewer and larger plats. Within the limits of the size and shapes of plats and number of replications used in the experiments, it is not considered possible to reduce the probable error below 2 per cent and to measure differences in yield of less than 6 per cent with certainty unless from 8 to 16 replications are made.

**The importance of the probable error concept in the interpretation of experimental results**, H. H. LOVE (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 6, pp. 217-224).—In this contribution from the Cornell University, the probable error is discussed as a measure of the reliability of the results as obtained in experiments, and a warning is given concerning its loose interpretation. Besse's and Peter's formulas and "Student's" method for the calculation of the probable error are compared, and their applications and limitations are pointed out. A similar paper has been noted earlier editorially (*E. S. R.*, 47, p. 707).

**Controlling experimental error in nursery trials**, H. K. HAYES (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 5, pp. 177-192).—Experimental evidence leading to the nursery methods now employed with cereals at the Minnesota Experiment Station is summarized, together with observations on the use of the computed probable error in determining the significance of the results obtained.

The yielding ability of selections or crosses as grown in small individual plats is held of little value as an indication of the comparative yielding ability of the separate selections. The rod-row method is in general use for obtaining preliminary yield tests of new plant-breeding productions. As a general rule in nursery trials, there is probably little value in correcting yields on the basis of near-by checks. Careful field experiments made it appear desirable



to employ 3-row plats, each row being about 16 ft. long and with only the central row harvested in the yield test. Replication has been found to generally reduce the probable error according to mathematical expectation. Four systematically distributed plats for each variety in the trial are suggested as desirable.

The probable error calculated from the deviation from the mean of the variety method is of about the same relative magnitude as that computed from the check plat method. If the test in rod-row trials is conducted properly, the use of the calculated probable error as a means of determining the reliability or significance of any particular strain comparison is considered justified, both from the mathematical and practical standpoints.

**Rate of seeding—a factor in variety tests,** R. K. BONNETT and F. L. BURKART (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 5, pp. 161-171, pl. 1, figs. 5).—The delivery rate of seeding a variety test with a grain drill can be accurately measured by means of a canvas frame designed at the Idaho Experiment Station to collect the surplus grain carried during seeding. Tests with varieties of field peas, oats, spring and winter wheat, and spring barley make it seem doubtful whether any scale of adjusted calibration can be devised for seeding the desired weight per acre of each of different varieties of small grains or peas. Determining the number of seeds to the pound in advance of seeding, and comparing with similar data, drill gauge and delivery rate of seeding for the variety in former years, would doubtless assist in adjusting the drill each season. If available for drills of various makes and types, such data would aid in recommending the proper drill rate for seeding different varieties of small grains and other crops.

**Studies of various factors influencing the yield and the duration of life of meadow and pasture plants,** R. G. WIGGANS (*New York Cornell Sta. Bul.* 424 (1923), pp. 3-24, figs. 6).—Cutting timothy before bloom, at bloom, in the dough stage, and when ripe gave evidence that late cuttings of new timothy meadows outweigh early cuttings the first year, but the difference is lost in succeeding years by greater weed development in the meadows cut late. Maximum yields can be obtained from old timothy meadows by cutting not later than the dough stage. Cutting timothy after full bloom permits weeds to develop, and these sooner or later exterminate the grass. In New York, the length of life of meadows can be increased and daisies controlled by early cutting.

Meadow yields can be largely maintained over a series of years by heavy annual applications of manure or fertilizer, according to fertilizer tests, but such yields are kept up by an accumulation of weeds which gradually exterminate the desirable vegetation. In the experiments reported, weeds appeared faster in old meadows with the use of fertilizer than with manure. Other tests indicated that there is a definite limit, varying with soil conditions, beyond which ample production can not be maintained in meadows by the use of fertilizer.

Seeding tests with grasses, clovers, and mixtures demonstrated that meadows should practically never be seeded to grass alone, even if a pure stand of grass is desired. Where adapted, red clover will outyield alsike in a mixture with clover and timothy and, in New York, will probably outyield mammoth clover. Although redtop is well suited for conditions too wet for timothy, its general use in meadow mixtures is considered doubtful. From 15 to 20 lbs. of seed per acre seems adequate for meadows. With uniformly distributed seed of high germinability, a considerable variation in the seed mixture used makes little material difference in the results.



Under meadow management, on soil of average fertility, the duration of orchard grass, tall oat grass, and blue grass is more or less indefinite, but timothy, redtop, meadow fescue, English rye grass, and brome grass are soon exterminated by competition with blue grass. This also holds true under pasture management, except that blue grass and orchard grass are the only grasses that remain, and the other grasses are replaced sooner by blue grass under pasture than under meadow management. The highest total yield under both types of management is obtained in the year after the seeding. Most of the coarser grasses, including timothy, tall oat grass, and orchard grass, yielded about one-half as much under pasture as under meadow management, and redtop and meadow fescue yielded about three-fourths as much. On the other hand, blue grass yielded slightly better under pasture management. Orchard grass and tall oat grass were the earliest producers in spring and were followed in order by blue grass, timothy, meadow fescue, and redtop. All grasses produced very sparingly during the late summer. In the fall, blue grass and redtop showed greater reinvigoration than the other grasses, while orchard grass grew best during the dry period of midsummer.

**Report of the Dominion cerealist for the year 1922**, L. H. NEWMAN (*Canada Expt. Farms, Cereal Div. Rpt. 1922*, pp. 1-6, 8-16, fig. 1).—The activities of the Cereal Division during 1922 are reviewed and yield and agronomic data tabulated from variety tests of spring wheat and rye, emmer, oats and barley for grain and hay, flax for seed, field peas, and field beans. The important varieties, selections, and hybrids developed under direction of the retiring cerealist, C. E. Saunders, are indicated.

**[Field crops work in Ireland in 1922]** (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 23 (1923), No. 1, pp. 78-97).—The continuation of experiments with various field crops (E. S. R., 47, p. 32) is reported for the year 1922.

**[Report of field crops work in Burma, 1921]**, J. CLAGUE, A. MCKERRAL, D. HENDRY, and T. D. STOCK (*Burma Dept. Agr. Rpt. 1921*, pp. 3-8; *Ann. Rpts. Agr. Stas. [etc.]*, 1921, pp. 1-16, 18-23, 27-34, 37-42, 45-48, 51-55, 58-63).—The progress of experiments noted earlier (E. S. R., 44, p. 733) is reviewed.

**[Field crops experiments in Travancore, India, 1921 and 1922]**, N. K. PILLAI (*Travancore Dept. Agr. and Fisheries Rpts. 1920-21*, pp. 4-9, 11-14, 34-38; 1921-22, pp. 1-16, 42-49).—The continuation of previous work (E. S. R., 46, p. 634) is reported.

**The winter resistance of cereals**, E. I. BABULINA (*Izv. Saratovsk. Selsk. Khoz. Inst. (Ann. Inst. Agron. Saratov)*, 1 (1923), No. 1, pp. 42-57).—Investigations were made at Saratov on rye and on varieties of wheat to determine the causes of differences in winter resistance.

Contrary to the findings of Kolkunov (E. S. R., 31, p. 32), who found that plants most resistant to drought and cereal varieties most resistant to winter-killing had smaller cells and higher osmotic pressure in the cell sap than less resistant varieties, a definite correlation did not appear to exist between the size of morphological characters of winter wheat varieties and their resistance to low winter temperatures. The varieties tested differed in cold resistance but not correspondingly to the lengths of their stomata. The average size of cells of resistant sorts was larger than in varieties that succumbed.

High osmotic pressure of the cell sap is not considered an infallible indicator of drought and cold resistance in a variety. In the author's tests the osmotic pressure of rye was lower than in several varieties of wheat, although no wheat variety could compare with winter rye in resistance to cold. Wheat varieties with the same osmotic pressure did not winter alike. In some cases, however, a close relation between the degree of osmotic pressure and cold and



drought resistance was observable. Most of the Persian varieties had a high osmotic pressure and suffered little from drought, although they were very susceptible to the winter cold. West European sorts such as Squarehead had low osmotic pressures in the cell sap.

The theory of anabiosis of A. I. Stebut,<sup>1</sup> wherein varieties characterized in autumn by prostrate seedlings are able to pass the winter in an anabiotical state, whereas varieties with erect seedlings are unfit for anabiosis and perish in winter under Russian conditions, was not confirmed. Varieties with prostrate forms in autumn differed in the way they survived the winter.

Correlation was observed between the geographical source of a variety and its manner of passing the winter. Varieties from middle and southeast Russia were most resistant to winter cold, whereas Persian and western European varieties, as well as nearly all sorts from Turkestan, were most susceptible. Selection of varieties best adapted to severe winters, by considering single characters only, is thought impossible.

**The response of different cereal varieties to nitrogenous fertilizers,** O. LEMMERMANN (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 2, *Wirtschaft.-Prakt.*, pp. 505-509).—The yields of several varieties of rye, untreated and receiving nitrogen alone and in a complete fertilizer, are tabulated and discussed. The varieties were observed to behave differently under the nitrogen applications, and some evidently responded better than others to heavy nitrogenous fertilizers. With confirmation of these results, such varied behavior should be taken into account in breeding work as well as in fertilizer practice.

**The effect of different reactions on the growth and calcium content of oats and wheat,** O. C. BRYAN (*Soil Sci.*, 15 (1923), No. 5, pp. 375-381, figs. 2).—Kherson oats and Marquis wheat plants were grown for two months in quartz cultures at different reactions from pH 3 to 10, supplementing work with alfalfa and clovers (*E. S. R.*, 49, p. 825).

The oat plants made their maximum growth at about pH 6, and the wheat at a slightly less acidity of pH 6 to 7. The oats grew at pH 4 and 5 much better than did the wheat and, in general, were less affected by acidity. The oats and wheat produced practically no growth at pH 3 and 10, which are near their critical reactions. An increase in acidity or alkalinity from the range pH 6 to 7 produced a decrease in the growth of both the oat and wheat plants. A decrease in acidity from pH 5 depressed the calcium content of the oat plants, but not of the wheat plants. The acidities which were injurious to the growth of the oats and wheat in this investigation are no greater than that of many acid soils.

**Alfalfa fertilizer experiments,** C. E. CRAIG and W. T. CONWAY (*New Mexico Sta. Bul.* 137 (1923), pp. 22, pl. 1, fig. 1).—The effect of single fertilizers (*E. S. R.*, 47, p. 433) and of inoculation on the growth of alfalfa under irrigation on adobe soil is described. Mechanical analyses revealed differences in texture of the surface 2 ft. of the soil and great variation in the subsoil.

The total yields and yields per acre-inch of water applied varied directly with the moisture and texture equivalent to a depth of 6 ft., and inversely with the total salts present in the upper 2 ft. of soil. The yield did not seem to be correlated with the percentage of clay and moisture content of the upper 2 ft. of soil and the amount of water applied in 1922. While both manure and acid phosphate probably increased alfalfa yields, the results do not seem to justify the expense of their use for alfalfa on the adobe soil. The other treatments appeared to be without results.

<sup>1</sup> Anabioz v Voprose o Perezimovyzanii Ozimeĭ, 1916. Vest. Selsk. Khoz., 1916, No. 6.



**Report on the experiments on the influence of soil, season, and manuring on the quality and growth of barley,** E. J. RUSSELL (*Jour. Inst. Brewing*, 29 (1923), No. 8, pp. 624-654).—At 13 centers in England, plats of Plumage-Archer barley receiving 1 cwt. ammonium sulphate, 3 cwt. superphosphate, and 1.5 cwt. potassium sulphate per acre were compared with plats successively omitting the potash, phosphate, and nitrogen, and with unfertilized plats. Yields were not severely affected by the unfavorable weather, but the quality was usually greatly depressed.

The complete fertilizer gave an increased yield at practically all centers, but only twice was the value affected. Ammonium sulphate generally enhanced the yield by about 5 bu. for 1 cwt. applied. Phosphates were ineffective at several centers on heavy soils, and on very light sand they apparently depressed the crop. Potassium fertilizers in several cases had a marked effect in increasing yield.

The market values of the samples were much more influenced by the soil and season than by fertilizing. No relation between fertilizer and quality was apparent with the samples as a whole, but with those of fair to good malting value nitrogenous fertilizers tended to lower the value and phosphates to raise it, while potassium had no consistent effect.

The nitrogen content of the grain was similarly influenced more by soil and seasons than by fertilizing. Nitrogenous fertilizers raised the nitrogen content of the grain and potassium tended to depress it, while phosphates were less effective. The reduction in value of grain usually associated with increasing nitrogen content was less when comparing barley from the same farm than when comparing barley from different farms. A statistical note by R. A. Fisher on the data relating to nitrogen content and valuation is included.

**The response of barley varieties to nitrogenous fertilizers,** O. LEMMER-MANN and K. ECKL (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 5, *Wirtschaft.-Prakt.*, pp. 265-272).—Eight varieties of barley were grown at Dahlem on sandy loam soil receiving standard amounts of potassium and phosphorus and 40, 60, and 80 kg. of nitrogen per hectare (35.6, 53.4, and 71.2 lbs. per acre, respectively).

Bethges II returned the highest and Berger Silesian common barley the lowest yields on the soil employed. The 60-kg. application produced grain increases of from 2 to 27 per cent and the 80-kg. from 7 to 39 per cent over the 40 kg. of nitrogen. Bethges II and Mahndorfer Hanna made rather small increases with the stronger applications, although they led the varieties with the 40 kg. Ackermann Danubia and Rimpau Hanna responded strikingly to 60 kg. and still more to 80 kg., whereas Ackermann Bavaria and Crieewener 403 made the same increases with both 60 and 80 kg. of nitrogen.

**Competition as a source of error in comparative corn yields,** T. A. KIESSELBACH (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 5, pp. 199-215).—Data from experiments at the Nebraska Experiment Station showing evidence of competition in normal fields and between adjacent unlike hills, a tendency toward equilization in uneven stands, plat competition in rate of planting tests and in variety tests, border competition in multiple-row plats, the optimum rates of planting for the variety, and the error caused by incomparable stands are cited as indicating the principle of unequal competition between adjacent hills or rows containing unlike sorts or unlike stands of corn. The degree of such competition will vary with the intensity of the limiting factors for growth and the degree of difference between the crops compared. This variability would appear to make it impracticable to work out general formulas for correcting yields subject to systematic errors or variations in the favorableness of stands.



The author feels that such sources of error may be avoided entirely or in part by grouping similar sorts, using multiple-row plats and discarding border rows wherever unlike sorts are adjacent, planting a surplus of seed and thinning plants to a uniform stand while small, and basing yields upon all hills containing the full number of plants and surrounded by a normal stand. Varieties differing markedly in vegetative development may have different optimum planting rates, and a reliable variety test may necessitate several rates of planting.

**Where did dent corn come from?** H. A. WALLACE (*Wallaces' Farmer*, 48 (1923), No. 33, pp. 3, 8).—According to historical evidence cited, dent corn seems to have originated by crossing the gourdseed type with flint corn. The hybrid origin is indicated as a cause of continual difficulty in holding a dent variety up to its maximum productivity.

**Some physical measurements on cotton fibers, and their graphical representation,** T. BARRATT (*Jour. Textile Inst.*, 13 (1922), No. 10, pp. 220–228, figs. 8).—The advantages of comparing actual curves obtained from experimental results with a probability curve is shown by graphic comparisons of the lengths, diameters, breaking stresses, and extensions of fiber of two kinds of Egyptian cotton.

**The mechanical testing of cotton materials** (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem.*, 2 (1923), No. 11, pp. 109–156, figs. 22).—This contribution from Shirley Institute comprises the following papers: The Measurement of the Mechanical Properties of Cotton Materials, by F. T. Peirce; The Effect of Humidity and Temperature, Regarded as Conditions of Testing, on the Strength of Cotton Yarns and Fabrics, by A. R. Urquhart; and The Machines Commonly Used in the Cotton Industry for the Testing of Materials, by E. Midgley.

The first two articles are summaries of the literature, and the third is an exposition of the apparatus employed in testing yarns and fabrics. Bibliographies conclude each paper.

**Flax in the different retting stages,** W. MÜLLER (*Faserforschung*, 3 (1923), No. 1, pp. 41–51, fig. 1).—Investigations at Sorau, where the Schopper test apparatus was employed on fiber from successive stages of flax retting, demonstrated that the strength of the flax fiber increases up to about the point which in practice is considered the end of the ret (7 to 8 days) and diminishes markedly after this stage. In industrial practice the maximum strength and yield are secured by carrying the ret up to the point indicated. The author concludes that a uniform ret can be obtained only after the material is carefully sorted.

**Analysis and interpretation of data obtained in comparative tests of potatoes,** C. H. MYERS and F. R. PERRY (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 6, pp. 239–253).—Comparative studies, at the New York Cornell Experiment Station, with hills from apical and basal ends of a large number of individual tubers under different rates of planting, showed definitely the effect of competition and that it may vary with varieties and conditions. The authors feel that Stewart's work on the effect of missing hills (*E. S. R.*, 47, p. 134) should be corroborated before adopting a definite formula of correction.

Although the 25-hill plat, run in series of 5 replications, gave a fair degree of reliability, 2 years' results with 500 such plats indicated that 10 replications should be adopted.

**Studies in crop variation.—II, The manurial response of different potato varieties,** R. A. FISHER and W. A. MACKENZIE (*Jour. Agr. Sci. [England]*, 13 (1923), No. 3, pp. 311–320, figs. 2).—Data from an experiment at Rothamsted



where 12 potato varieties were subjected to 6 fertilizer treatments showed a clearly significant variation in yield due to fertilizer treatment and variety. No significant variation was observed in the response of different varieties to fertilizer. The yields of the different varieties under different fertilizer treatment appeared to be better fitted by a product formula than by a sum formula. For the purpose of analyzing the variation, the product formula may be obtained by successive approximation from equations given.

The first paper of this series (E. S. R., 46, p. 137) concerned variations in wheat yields under continuous cropping.

**The effect of potassium and magnesium on the yield and quality of potatoes,** O. MARHOLDT (*Landw. Vers. Sta.*, 100 (1923), No. 6, pp. 315-340).—Potatoes were grown at Giessen on plats receiving magnesium salts alone and in combinations with potassium salts, complete fertilizers, green manure, and stable manure.

Magnesium salts alone, or without humus, did not have a particularly favorable effect on the development and yield of potatoes. Magnesium chlorid was generally accompanied by a reduction in the starch content, either with a complete fertilizer or an application omitting either nitrogen, phosphorus, or potassium. Potassium sulphate alone often was nearly as effective as the combination of magnesium and potassium salts. The sulphate is the only one of the magnesium salts that could be considered as yield-increasing in this case.

Humus-making material supplementing a complete mineral fertilizer enhanced the yields considerably. Green manuring with yellow clover increased yields, particularly when supplementing the potassium-magnesium sulphate combination. The starch content was reduced substantially by the use of either green manure or stable manure. The starch yield, as a rule, increased with the increase in tuber yield. Supplementing the complete fertilizer with stable manure was much more effective than the addition of green manure, giving an increase in tuber yield of from 20 to 40 per cent, and over 50 per cent with the potassium-magnesium sulphate. Magnesium carbonate and chlorid salts with either potassium sulphate or chlorid showed yields approaching that obtained with potassium sulphate alone, but all of these were below that secured with the potassium-magnesium sulphate.

**Rice and rice products,** S. C. YIEN ([*Soochow*]: *Soochow Univ., Biol. Dept.*, pp. 12).—Cultural methods and field practices employed by the Chinese in rice growing are outlined, with a list of varieties and methods of preparing a number of foods from rice.

**Rate of seeding and fertilizing of rye,** O. LEMMERMAN (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 3, *Wirtschaft.-Prakt.*, pp. 142-146).—This review of data cited from experiments of Schulze (E. S. R., 34, p. 37), Bieler (E. S. R., 36, p. 532), W. Schneidewind,<sup>1</sup> and others with rye recommends in general for light sandy soil well fertilized a seeding of not more than 80 to 110 kg. per hectare (71.2 to 97.9 lbs. per acre).

**Pictorial atlas of the sugar beet,** O. O. TABENT'SKIĀ (A. A. TABENZKI) (*Bilderatlas der Anatomie und Biologie der Zuckerrübe (Beta vulgaris L. var. Saccharifera)*). Kief: Zuckertrustes, 1922, pp. XVI+142, figs. 329).—This comprehensive folio depicts, by means of gross illustrations and microscopic enlargements, the morphological characters and life processes of the sugar beet through the successive stages from the flower and seed until the crop is ready for harvest. Illustrations are also given of the plant during the second year, vegetative propagation, hybrids, the use of the microscope in selection work, im-

<sup>1</sup> Arb. Deut. Landw. Gesell., No. 283 (1916).



portant sugar beet varieties, and items of historical interest in the sugar beet industry. Legends are supplied in German, Russian, and Ukrainian.

**The sugar-cane project of the [Philippine] Bureau of Agriculture, S. ASUNCION and M. MEDINA** (*Philippine Agr. Rev.*, 16 (1923), No. 1, pp. 22-29).—Experimental work with sugar cane in the Philippine Islands since 1903 is reviewed.

Foreign varieties found best include Hawaii 109, Hawaii 309, Hawaii seedlings Nos. 16, 20, and 227, Louisiana Striped, Yellow Caledonia, Badila, Formosa, Java 247, and Cheribon, and among the best native varieties are Negros Purple, Mindoro, Inalmon, Luzon Nos. 1, 2, 3, and 4, and Cebu Purple. Plats treated with bagasse ash, burnt lime, copra meal, and barnyard manure have produced actual net profits as compared with untreated plats. Increased tonnage, sucrose content, and stooling and earlier arrowing followed the use of a mixed fertilizer. Mosaic was found prevalent among the different varieties, and leaf spot was observed to slightly affect Cheribon and Demerara 1135.

**The deterioration of cut cane in Pampango (P. I.)** (*Sugar Cent. and Planters News*, 4 (1923), No. 1, pp. 7-15, figs. 5).—Pampanga Red sugar cane, topped and allowed to stand for 1, 3, 4, and 5 days before cutting and milling, showed respective contents of 1.75, 1.6, 1.26, and 1.34 piculs of sugar per ton, as compared with 1.93 piculs (270 lbs.) in cane cut and loaded immediately. Cane cut and allowed to lie in the field for 1, 3, 4, 5, and 7 days before milling had 1.6, 1.45, 1.22, 1.31, and 1.15 piculs of sugar per ton, respectively, while cane cut and loaded at once had 1.91 piculs. Cane placed in a shaded loading station just after cutting and loaded at once and 1, 3, 4, 5, and 7 days after contained 1.93, 1.78, 1.82, 1.69, 1.58, and 1.22 piculs of sugar per ton, respectively. During the daylight hours, the temperatures in the field were often as much as 20° F. greater than in the loading shed, explaining the smaller losses in the shed. The need of prompt hauling of cane is indicated as almost as great as prompt loading after topping or cutting.

**Aboriginal tobaccos, W. A. SETCHELL** (*Amer. Anthropol., n. ser.*, 23 (1921), No. 4, pp. 397-414, pl. 1).—The species of *Nicotiana* used by North American Indians are described briefly, and their approximate distribution is indicated on an outline map. Of 14 North American species, either growing wild or in aboriginal cultivation, the author has evidence of the use of 9 species or varieties by different tribes of American Indians at present, chiefly for ceremonial purposes.

**Comparisons of the principal types of Deli tobacco, S. C. J. JOCHIMS** (*Meded. Deli Proefsta. Medan*, 2. ser., No. 25 (1923), pp. 37, pls. 8).—Studies of the seven leading selections of Deli tobacco (E. S. R., 48, p. 231) showed Line 8 outstanding and followed by Line 72. Line 8 was characterized by a high yield of cured leaf, excellent color, good leaf surface, and from 33 to 43 leaves, averaging 36.7.

**Tobacco: Soils and fertilizer experiments, J. DU P. OOSTHUIZEN** (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 1, pp. 21-35, figs. 14).—Soil, nutrient, and climatic requirements of tobacco are discussed, with an account of fertilizer tests with the crop at Rustenburg Experiment Station. Analyses of the station soils, including light brown sandy loam, black turf, and brown sandy loam, are tabulated.

Lime increased the yield of tobacco considerably on the acid soils of the station, without detriment to leaf quality. Phosphates, and to a smaller extent potash, increased the percentage of cigarette leaf and nitrogen decreased it. Kraal manure gave the heaviest yield and the largest profit, but with a smaller percentage of cigarette leaf than the complete fertilizer.



**Fertilizer experiments with tobacco in 1922** [in Sumatra], E. SIDENIUS (*Meded. Deli Proefsta. Medan*, 2. ser., No. 26 (1923), pp. 34).—Fertilizer tests with tobacco at different centers in Sumatra are reported for the season indicated.

**The cigar tobacco industry in Pennsylvania**, W. FREAR, E. K. HIBSHMAN, and O. OLSON (*Penn. Dept. Agr. Bul.* 371 (1922), pp. 90, figs. 40).—A practical account of methods and practices involved in the production, curing, preparation, and marketing of cigar tobacco in Pennsylvania. A historical sketch is included, together with production statistics and notes on disease and insect control, manufacturing, cropping systems, financing, organization, and research.

**The difference in the productivity of the two sides of the wheat spike**, B. KAJANUS (*Arkiv. Bot.*, 17 (1922), No. 8, pp. 12).—Statistical studies were made on typical material from the principal species of wheat, including *Triticum speltoides*, to ascertain the relative value of the two sides of the spike. The side (A) bearing the two lowest spikelets was generally more or less superior in number of kernels per spikelet, whereas the single kernel weight was alternately larger on one side (A) and the other (B). Side A always surpassed side B in regard to weight of kernels per spikelet. With *T. monococcum*, the single-kernel weight, which here coincided with the weight of kernels per spikelet, was always larger on side A.

**The spike structure of smutted wheat plants**, B. KAJANUS (*Landw. Jahrb.*, 58 (1923), No. 2, pp. 303–311).—Diagrams of normal and smutted (*Tilletia tritici*) spikes of winter wheat show the number of kernels on smutted spikes to exceed considerably that on normal spikes and with about twice as many kernels in the smutted as in the normal spikelet. The superiority of the B-side of the spike was very distinct in both classes of material.

**The best stage for cutting wheat**, F. W. HILGENDORF and J. W. CALDER (*New Zeal. Jour. Agr.*, 26 (1923), No. 6, pp. 354–357).—Thirty evenly distributed plats of Solid-straw Tuscan wheat at Canterbury Agricultural College were cut at each of five stages of ripeness three days apart, commencing about two weeks before the estimated maturity. Statistical treatment of the yield data showed chances of 25,000 to 1 that an increased weight was securable by waiting until the third stage, but only risk of loss by waiting longer. This stage may be defined as when the green has been replaced by yellow in the top internode of 99 per cent of the stems, all nodes are still green, and no dough can be squeezed from the kernel, but the latter is yet soft enough to cut with the thumb-nail.

**Crop breeding and seed production**, L. WITTMACK (*Jahrb. Deut. Landw. Gesell.*, 36 (1921), pp. 169–190; 37 (1922), pp. 163–176).—The characteristics are given of outstanding varieties and hybrids of winter and spring wheat, rye, barley, oats, legumes, clovers, grasses, potatoes, and root crops, as recently brought forward by German plant breeders.

**Report of the International Seed Testing Conference, 1921**, edited by K. DORPH-PETERSEN (*Jour. Essais Semences* [Copenhagen], No. 1 (1922), pp. 135, pl. 1).—The proceedings of the conference at Copenhagen in June, 1921, are reported. Among the papers presented were The Danish State Seed Testing Station, and Investigations of the Purity of Strain and Freedom of Seed from Disease, both by Dorph-Petersen; General Views Concerning the International Unification of Methods of Testing Seeds in the Interest of Trade, More Especially with Regard to the Purity of Seeds, by F. F. Bruijning; The Determination of the Origin of Agricultural Seeds, by A. Volkart; The Seeds Act 1920 and the National Institute of Agricultural Botany, by L. Weaver;



Seed Testing in the United Kingdom, by C. B. Saunders; Seed Testing in the United States of America, by E. Brown; Seed Testing and Seed Control in Canada, by G. H. Clark; The Present Status of Methods of Germination Tests, and General Directions for Germination Tests, both by A. Voigt; The Germination of Cereals, by J. Widén; The Testing and Valuation of Beet Seed, by K. Komers; The Testing of Dodder Seeds, by E. Vitek; Remarks on Dodder Seeds, by A. von Degen; and The Measures Taken in France to Combat Dodder, by L. Bussard.

**Weeds**, T. PETCH (*Ceylon Dept. Agr. Yearbook, 1923, pp. 59, 60, pl. 1*).—Among weeds recorded recently in Ceylon are *Drymaria cordata*, *Eleutheranthera ruderalis*, *Polygonum punctatum*, *Schizoea digitata*, *Typhonium roxburghii*, and *Pilea muscosa*.

[**The eradication of lavalala (*Cyperus rotundus*)**], W. BURNS (*Bombay Dept. Agr. Ann. Rpt., 1921-22, p. 95*).—Studies under direction of the author disclosed that the tubers germinate best when planted from 9 to 18 in. beneath the surface. Below 2 ft. little germination took place, but some tubers were able to send shoots to the surface from a 3-ft. depth. With constant removal of their aerial parts, the tubers became exhausted in from 7 to 12 weeks and died. Exposure to the sun for 10 days in May also killed the tubers.

## HORTICULTURE.

**Picking, handling, and exhibiting fruit**, T. J. TALBERT and A. M. BULLOUGH (*Missouri Sta. Circ. 113 (1923), pp. 7, fig. 1*).—Brief suggestions are given concerning methods of determining the proper degree of maturity of various fruits for picking, utensils for harvesting, care of fruit during the interim between harvesting and selling, and the selection of fruit for exhibits.

**Storage experiments with apples, 1922-1923**, G. LIND (*K. Landtbr. Akad. Handl. och Tidskr., 62 (1923), No. 5, pp. 429-434*).—This is a report upon the relative keeping quality of several varieties of apples held in natural and artificial storage.

**The strawberry, its culture and varieties**, P. THAYER (*Ohio Sta. Bul. 364 (1923), pp. 62-98, figs. 31*).—In addition to general suggestions relating to the culture of the strawberry, brief descriptive notes are presented on a large number of varieties tested at the station, and a list of recommended varieties arranged according to the season of maturity is included.

**Grape breeding and the creation of direct bearing hybrids**, E. KUHLMANN (*Rev. Vitic., 59 (1923), No. 1529, pp. 253-260*).—This is a general article dealing with the structure of grape flowers, classifying varieties according to the length of the stamens in respect to that of the pistils, and discussing the results of breeding work with varieties of European and American ancestry.

**A study in cross-pollination of avocados in southern California**, A. B. STOUT (*Calif. Avocado Assoc. Ann. Rpt., 1922-1923, pp. 29-45, figs. 15*).—Self-pollination is believed to be practically impossible in the avocado, since the individual flowers of all the varieties studied normally have two distinct periods of opening, the first in which the pistils are receptive and the second in which the pollen is shed. The author discusses, with the aid of photographs and charts, the behavior of the flowers of many important varieties.

So definite are the hours of pistil receptiveness and pollen shedding during warm sunshiny weather that most varieties may be grouped as normally forenoon or afternoon shedders of pollen. Although in certain cases overlapping was found to occur more or less on individual trees, nevertheless it is doubted that the time involved is sufficient to insure adequate pollination. Hand-pollination between varieties in the two classes were not sufficiently successful



to allow the deduction of any general conclusions as to compatibility between the groups, but it was indicated that the time of most favorable pollination is decidedly brief, the pistils being receptive for only a very limited period. As a result of the studies, the author concludes that mixed interplanting should be practiced, with the trees planted very close to one another, or perhaps two or more varieties should be grafted on a single trunk.

**Analyzing the citrus orchard by means of simple tree records,** R. W. HODSON (*California Sta. Circ.* 266 (1923), pp. 20, figs. 11).—Emphasizing the fact that even in profitable citrus orchards there are a considerable number of trees which are consistently low producers, the author points out the desirability of keeping records of the performance of each tree. It is suggested that individual records will show which of three factors, namely, cultural practices, inherent characters in the tree, and environmental conditions, may be responsible for success or failure. Methods of plotting orchards and keeping and analyzing production records are discussed. The grouping of poor producing trees in zones or in special areas is evidence that environment is affecting the production, while the scattering of unproductive trees, with no apparent interrelation, indicates inherent variations within the trees themselves. Environmental factors, such as moisture, fertility, and soil variations may be overcome in whole or in part by analyzing the cause and applying proper remedial measures. Variations inherent in the tree must be overcome by top-working with productive scions or in certain cases by replacing the entire tree.

**Changes in stored oranges,** G. ANDRÉ (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 25, pp. 1399–1401).—During storage of oranges observations were made after 23, 28, 43, 44, 51, 60, 62, and 72 days. It is stated that maturation progresses in the sense that there is a notable diminution of acidity. This is probably due not only to oxidation but also to diastatic action.

**Bordeaux-oil emulsion,** J. R. WINSTON, J. J. BOWMAN, and W. W. YOTHERS (*U. S. Dept. Agr. Bul.* 1178 (1923), pp. 24, figs. 3).—Bordeaux-oil emulsion, a mixture of 3–3–50 Bordeaux and 1 per cent of oil in the form of an emulsion, indicates promise as a spray in Florida citrus groves, both component materials proving as effective in mixture as when used alone. Commercial Bordeaux preparations and homemade mixtures of poor physical properties when combined with oil emulsions proved practically as effective against citrus scab and melanose as did homemade Bordeaux mixtures plus oil emulsion when used on the basis of equal amounts of copper in the diluted spray. Combined sprays showed no more tendency to injure tender fruit and foliage than when the component materials were applied separately. In addition, Bordeaux-oil emulsion settles less rapidly, spreads more uniformly, and adheres as well as Bordeaux alone.

**Dahlias for the home,** B. Y. MORRISON (*U. S. Dept. Agr., Farmers' Bul.* 1370 (1923), pp. II+17, figs. 15).—Concise information is presented concerning the growing of the dahlia, including classification according to type of flowers, methods of propagation, planting, cultivation, and winter storage of the roots.

**Roses and how to excel with them,** R. V. G. WOOLLEY (*London: Country Life, Ltd.; New York: Charles Scribner's Sons*, 1923, pp. VII+119, figs. 23).—Popular information relating to culture, garden plans, and varieties.

**The history of old country gardens of Switzerland and neighboring localities,** H. CHRIST (*Zur Geschichte des Alten Bauerngartens der Schweiz und Angrenzender Gegenden. Basel: Benno Schwabe & Co.*, 1923, 2. ed. enl., pp. 161, pl. 1, figs. 21).—This comprises popular information.



**The cultivated evergreens**, edited by L. H. BAILEY (*New York: Macmillan Co.; London: Macmillan & Co., Ltd., 1923, pp. XVII+434, pls. 48, figs. 97*).—This elaborate volume, prepared by several authors, is presented in four parts. The first treats of the utilization and care of coniferous evergreens grown for ornamental purposes, the second comprises descriptive and historical information concerning the kinds of evergreens cultivated in North America, the third discusses broad-leaved evergreens, and the fourth is an alphabetically arranged inventory of woody evergreens grown in North America.

**Taming the wildings**, H. DURAND (*New York and London: G. P. Putnam's Sons, 1923, pp. XXIX+380, pls. 23, figs. 140*).—A book of cultural information on wild flowers, bushes, and ferns. The foreword is by E. T. Wherry.

## FORESTRY.

**Forests and forestry in the United States**, H. A. SMITH (*U. S. Dept. Agr., Forest Serv., 1922, pp. 16, pls. 5*).—This report, which supplemented the exhibit of the U. S. D. A. Forest Service at the Brazil Centennial Exposition at Rio de Janeiro, 1922-1923, contains general information concerning the forests of the United States, the original and the present extent, the long continued lack of appreciation of their value, the exhaustion of the eastern forests, the rise of the lumber industry, forest fires and their disastrous consequences, the development of sentiment in favor of forest preservation, and the creation of national and State forest reserves.

**Lake States Forest Experiment Station and its field**, R. ZON (*Lumber World Rev., 45 (1923), No. 9, pp. 61-63*).—A brief statement concerning some of the problems to be studied by the recently organized (September, 1923) Lake States Forest Experiment Station (*E. S. R., 49, p. 401*).

**Scientific research and southern Appalachian forests**, E. H. FROTHINGHAM (*Lumber World Rev., 45 (1923), No. 9, pp. 47-52, figs. 8*).—In this discussion of the current work and research projects of the Appalachian Forest Experiment Station of the U. S. D. A. Forest Service, at Asheville, N. C., the author describes the present condition of the forests, lists the constituent species, and discusses the possibilities of developing rational silvicultural practices, including fire protection and general management.

**Talks on forestry**, G. PINCHOT (*Penn. Dept. Forestry Bul. 32 (1923), pp. 28, pls. 8*).—Emphasizing the serious lack of timber in Pennsylvania brought about in part by destructive methods of forestry, the author explains how, by preventing fire, enlarging the State holdings, and practicing modern forestry methods, Pennsylvania forests and potential forest lands may be brought back to a productive condition.

**Tree ancestors, a glimpse into the past**, E. W. PERRY (*Baltimore: Williams & Wilkins Co., 1923, pp. VI+270, pl. 1, figs. 48*).—Based upon paleobotanical studies, popular information is presented in this text upon the origin, ancient distribution, and probable antiquity of many of the existing forest trees.

**Forest distribution in the northern Rocky Mountains**, J. E. KIRKWOOD (*Mont. Univ. Studies No. 2 (1923), pp. 180, figs. 45*).—An ecological study of forests and underlying plants found in Montana and neighboring parts of Idaho, an area where because of the great range in elevations there are present a wonderful diversity of forest types.

**I, The forest situation in California, 1923. II, County organization for rural fire control**, E. N. MUNNS and W. METCALF (*Calif. State Bd. Forestry Circ. 7 (1923), pp. 64, figs. 21*).—The first part of this paper, by the senior author, is largely of a statistical nature, presenting data regarding the present size of California forests, stands of marketable timber, the principal species,



acreage of potential forest lands needing planting, acreage requiring fire protection, and location of national forests according to counties. Part 2, by the junior author, relates to recently developed programs for combating fires.

**Some results of cutting in the Sierra Forests of California, D. DUNNING** (*U. S. Dept. Agr. Bul. 1176 (1923), pp. 27, pls. 8, figs. 2*).—A report upon studies of growth and reproduction on 25 permanent sample plats located in the Sierra timber belt from near Mount Shasta to a point southwest of Mount Whitney.

The rate of growth of stands left after cutting was largely dependent upon the quality of the site, observations indicating that no method of cutting on No. 3 or poorer sites will result in a rate of growth sufficient to justify leaving any considerable volume of nearly mature trees for further growth. White fir ranked first in rate of growth, followed by sugar pine, Douglas fir, yellow pine, and incense cedar. Sugar pine maintains a high rate of growth to a greater age and diameter limit than any of the other species. Upon site 2 or better, diameter limits are approximately 30 in. for sugar pine, 26 in. for yellow pine, and 24 in. for white fir and incense cedar. In selecting trees for reserve growth it was observed that individuals with narrow, long crowns of a dense rich green appearance had the greatest possibilities of increased growth. In general, trees left in groups failed to gain as rapidly as individuals with adequate room for root and crown development. The net rate of volume increment for stands on sites 1 to 3, averaging about 15,000 ft. b. m. per acre, was from 53 to 470 ft. b. m. per acre annually.

The importance of advance reproduction as a measure in securing forest renewal was shown in the fact that following cutting except on sites 1 and 2 there was found no appreciable increase in the amount of reproduction on early sale areas cut over lightly by group selection and shelter-wood methods. Attempts to increase valuable species, namely, yellow and sugar pines, by leaving abundant seed trees and marking white fir and incense cedar as closely as economic conditions would permit failed of result, the fir and the cedar alone showing any tendency to increase. Light cutting, heavy litter, brush, and ground cover apparently favored fir and cedar, and on certain sites the fir naturally succeeds pine. Even with careful practice, brush piled after cutting was found to cover from 6 to 10 per cent of the area. Shrubs interfere materially with reproduction, but are gradually topped by tree seedlings, especially white fir. Marking designed to promote natural regeneration should give primary consideration to existing advance reproduction, cutting being sufficiently heavy to release young trees and every precaution being taken to prevent unnecessary injury. It is estimated that the presence of adequate reproduction at the time of cutting will shorten the rotation by from 5 to 20 years or more.

**Forest trees of the District of Columbia, including some foreign trees, W. R. MATTOON and S. S. ALBERTIS** (*Washington: Amer. Forestry Assoc., 1923, pp. 64, figs. 64*).—This pamphlet is similar to that prepared for South Carolina (*E. S. R., 50, p. 40*).

**Second growth hardwood forests in Michigan, P. L. BUTTRICK** (*Michigan Sta. Spec. Bul. 123 (1923), pp. 19, figs. 5*).—Stating that the forests of northern Michigan are divided sharply into three distinct types, (1) pine, consisting at its best of white and red and at its poorest of jack pines, (2) swamp, consisting of a mixture of white cedar, balsam, tamarack, and various other species, and (3) hardwood, consisting of a mixture of sugar maple, American elm, and other species, the author discusses that portion of the hardwood type which occurs in the northwestern part of the Lower Peninsula. Here the nature of the original cutting and subsequent fires have resulted in various distinct types of



second growth, the composition, general character, and rate of growth of each of which are discussed by the author. The relative advantages of selective and clear cutting are considered, and methods of silvicultural management of the young second growth are outlined.

**Improvement of the farm woodlot**, A. K. CHITTENDEN (*Michigan Sta. Spec. Bul.* 122 (1923), pp. 22, figs. 7).—Emphasizing the importance of the farm woodlot to the agriculture of Michigan, information is presented relative to the comparative rate of growth of various important forest species and methods of thinning for promoting consistent growth and reproduction. Figures are presented showing the yield of timber that may be expected in well managed woodlots, and formulas are given for estimating the volume of standing timber and of cut logs. It is emphasized that the woodlot must be protected from fire, overgrazing, diseases, insects, and wind injury. When the woodlot is also utilized as a sugar bush the method of management is different, in that the sugar maples must be allowed adequate sunlight and room for developing crowns.

**Forestry for profit: How the woodlot can be made to pay**, T. TUNIS (*New York and London: G. P. Putnam's Sons*, 1923, pp. XIII+296, pls. 17).—This book outlines a new silvicultural practice wherein by pruning and cultivation forest plantations may be brought to an early profitable condition.

**Forestry of Japan** (*Toyko: Dept. Agr. and Com., Bur. Forestry*, 1923, pp. 69, pls. 6).—This paper contains information relative to the distribution of the forests of Japan, the more important species in the various areas, and general administrative, educational, and investigational activities. Tabulated information is presented on exports and imports.

**Report on forest administration in Burma for the year ending March 31, 1922**, C. B. SMALES ET AL. (*Burma Forest Admin. Rpt.*, 1922, pp. [6]+138, pl. 1).—The usual report (*E. S. R.*, 48, p. 240) relating to alterations in area, general management and investigational activities and statistics.

**Forest line**, F. J. LEWIS (*Canad. Alpine Jour.*, 13 (1923), pp. 130-136, pls. 2).—In a general discussion concerning the factors governing tree and other plant life development at the upper limits of vegetation, the author expresses the belief that wind and snow, rather than temperature, are the factors limiting growth at these higher elevations. For instance, in the Rocky Mountains, the average forest line lies at 7,000 ft., while in the central mountains of Vancouver Island, where the temperatures are much more moderate, the average is about 5,300 ft.

**Wild black cherry in northern Pennsylvania**, J. N. MORTON (*Forest Leaves*, 19 (1923), No. 6, pp. 92-94).—This tree, sometimes attaining in favorable locations a height of 100 ft. and a diameter of from 4 to 5 ft., is considered an important constituent of the second growth hardwood stands of northern Pennsylvania. Measurements show that at 14 years the average diameter, breast height, was 4.4 in., at 16 years 5.2 in., and at 24 years 6.2 in., indicating that the tree is a rapid grower. However, it is recommended that close planting be practiced in order to insure straight upright trunks.

**Dwarf and slow-growing conifers**, M. HORNIBROOK (*London: Country Life, Ltd., New York: Charles Scribner's Sons*, 1923, pp. X+195, pls. 25).—An attempt is made in this text to bring together descriptive material relating to all known forms.

**Experimental errors of field trials with Hevea**, C. H. GADD (*Ceylon Dept. Agr. Bul.* 66 (1923), pp. 22, pls. 6).—Emphasizing the great possibilities of error in Hevea experiments on account of the large size of individual trees and the variation in depth of penetration of roots, the author suggests the advisability



of using small duplicate plats scattered over a large area, and also the use of the method of probable error in determining the significance of variations in yield.

Some recent progress in the art of kiln-drying, R. THELEN (*Lumber World Rev.*, 45 (1923), No. 9, pp. 59-61, figs. 6).—This paper relates to the research work conducted by the U. S. D. A. Forest Service in the laboratories at Madison, Wis., and in the field.

The French lumber market, J. F. BUTLER (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform Bul.* 51 (1922), pp. II+13).—Data are presented in this pamphlet relative to production, imports and exports, utilization of various species, amount of imports from the colonies, and general condition of the trade.

## DISEASES OF PLANTS.

**Mycology [in India]**, W. BURNS (*Bombay Dept. Agr. Ann. Rpt.*, 1919-20, p. 129).—Study of potato tampera disease proved this to be due to a mite and easily controlled by sulphur treatment.

Inoculation of potato tubers and plants with pure cultures of *Rhizoctonia solani* yielded no results. Black rot appears to be due to heat, as is black heart in America. A new *Fusarium* has been isolated as the cause of tuber brown discoloration and rotting. The tuber dry rot fungus (*F. trichothecioides*) thrives between temperatures of 25 and 30° C. (77 and 86° F.).

The tampera disease of citrus trees, previously diagnosed as scab, proved to be due to mites. Most of the local varieties are affected, especially tender roots, leaves, and fruits of the varieties Santra and Musumbi.

Tests of smut resistance in the milo varieties Standard and Dwarf showed that both were resistant to the grain smut (*Sphacelotheca sorghi*) and not to the loose smut (*S. cruenti*). Smut on *Panicum frumentaceum* has been recorded, and this is to be studied.

Rice sclerotial disease is said to have spoiled the crop in more than 1,000 acres in the Thana District.

The campaign against the koleroga disease of the Supari palm is being extended.

**Annual report of the work done under the plant pathologist to Government of Bombay, Poona, for the year 1921-22**, S. L. AJREKAR (*Bombay Dept. Agr. Ann. Rpt.* 1921-22, pp. 102-104).—The main portion of this report is occupied with plant disease research.

Potato wilt appears to be caused by a fungus (*Fusarium oxysporum*?) distinct from the dry-rot *Fusarium*. Study of storage rots has thrown doubt on the supposed identity of heat rot with black heart as described by American authors, and has supplied evidence that so-called heat rot is really the combined effect of *Fusarium*, *Rhizoctonia* (*Sclerotium* spp.), and bacteria, acting vigorously at the high temperatures obtaining here in potato storage. Heat alone does not produce the rot in the absence of the organisms at 42° C. (107.6° F.), but the disease appears even at 29.4° C. (85° F.) when the organisms are present. Some of the fungi (*F. trichothecioides*?) thrived best at the low temperature of 85° F. No treatment with fungicides was protective. The solution is probably to be sought in further reduction of the storage temperature.

Cotton wilt was studied as to resistant varieties, among which the strains Wagale and Dharwar No. 2 are mentioned favorably. No difference in wilt susceptibility between tall and bushy types was found.

Onion leaf spot and blight, which is more severe in the coastal regions and which has been rated as the main obstacle to onion culture extension in

North Kanara, is due to an *Alternaria*, favored probably by the presence of thrips. Red strains are less susceptible than white varieties. Thin planting appears to prevent the disease. Bordeaux mixture may prove to be a preventive.

Miscellaneous observations on crop diseases include a reddening of leaf sheaths of the Pundya variety of sugar cane, due to *Cytospora sacchari*; a Fusarium wilt (foot rot) of wheat; a collar rot of egg plant and chilies, associated with *S. rolfsii* (*R. destruens*); a citrus die-back at Loni (*Diplodia* sp.?); and sugar cane leaf spot (undetermined).

Experiments with smut on *Eleusine coracana*, involving seed treatment with 2 per cent copper sulphate for 10 minutes, showed good results as regards protection and strikingly increased growth on the treated plats.

**Vegetable parasites of cultivated plants**, L. MANGIN (*Parasites Végétaux des Plantes Cultivées*. Paris: Libr. Agr. Maison Rustique, 1914, vol. 1, pp. VIII+159, figs. 71; 1921, vol. 2, pp. [2]+159, figs. 61).—Of the two main parts comprising this compact collection of information regarding such causes of loss to producers as bacteria, slime molds, fungi, and phanerogamic parasites, the first part deals with cereal, truck, forage, and pot plants; the second with vineyard, orchard, field, and other plants, and preparations for control of plant diseases.

**Some characteristics of the virus diseases of plants**, E. J. BUTLER (*Sci. Prog.* [London], 17 (1923), No. 67, pp. 416-431; *abs. in Nature* [London], 111 (1923), No. 2790, p. 551).—The present discussion gives an inclusive, historical, areal, and bibliographical account of virus diseases of plants, dealing specifically with transmission, movement within the plant, properties, and environment, and recording certain observations. As a class, the diseases mentioned in this paper rank at present among the most destructive diseases of plants.

**Parasitism and resistance shown by plastids and mitochondria**, J. BEAUVÉRIE (*Compt. Rend. Acad. Sci.* [Paris], 172 (1921), No. 19, pp. 1195-1198).—Studies indicated here only in part (postponing details) as dealing with certain normal or parasitized plants show that resistance to parasitic action by mitochondria and plastids varies with age of the tissues in ways suggesting the utilization of information in studies on the mechanism of parasitism and in control measures.

**The mechanism of parasitic action by *Penicillium glaucum* and *Mucor stolonifer***, P. NOBÉCOURT (*Compt. Rend. Acad. Sci.* [Paris], 174 (1922), No. 26, pp. 1720-1722).—Experimentation with *P. glaucum* and *M. stolonifer* on tomato, pear, and apple is thought to indicate that the destructive action exercised on these plants is due to substances secreted by the fungi, diffused in the sap, and recoverable therefrom. These agents appear to be enzymatic as to their nature, since they lose temporarily near 0° and permanently near 60° C. their destructive action, and in other ways show agreement with enzymes as to behavior.

**Specialized varieties of *Puccinia glumarum*, and hosts for variety *tritici***, C. W. HUNGERFORD and C. E. OWENS (*Jour. Agr. Research* [U. S.], 25 (1923), No. 9, pp. 363-402, pls. 6).—In a former paper (*E. S. R.*, 49, p. 748) the economic importance and geographical distribution of *P. glumarum*, its life history, taxonomy, and morphology were described. The present publication deals with the known hosts of the rust and the present knowledge of specialized varieties. This work, which was carried on in cooperation between the Bureau of Plant Industry, U. S. D. A., and the Oregon and Idaho Experiment Stations, has shown that *P. glumarum* is widely distributed in the western part of the United States, and field collections have been made on wheat, barley, rye,



spelt, and emmer, as well as on 33 wild grasses. Artificial inoculations have added 26 grass hosts, making a total of 59 species of wild grasses which are known to be hosts of this rust in the United States. The common specialized variety of stripe rust is said to be *P. glumarum tritici*, and field observations are reported that indicate that *P. glumarum hordei* also occurs in this country on barley. The specialized variety from wheat was found to infect rye moderately and barley slightly, and it will also infect 47 wild grasses.

There is said to be some evidence indicating that there are several strains of grass species which react differently to the same variety of the rust, and there is some indication that there are two or more strains or specialized forms of *P. glumarum tritici*.

Varieties of wheat and wheat allies to the number of 163 have been tested for resistance to stripe rust in the field, and 92 varieties of wheat were tested in the greenhouse. With few exceptions the results of the field and greenhouse studies agreed quite closely. There was found to be a very marked difference in the susceptibility of various varieties of wheat to stripe rust, more of the common wheat varieties appearing to be resistant to stripe rust than are resistant to stem rust. Comparatively few of these varieties were found to become infected in the head under the conditions of the experiment. Varieties which did develop head infection were greatly reduced in yield. Leaf infection in the seedling stage was found more severe in spring-sown wheat, while leaf infection at heading time was more severe in fall-sown wheat. Several varieties proved very resistant to the strains of the rust studied.

**The toxicity of phenols for *Sterigmatocystis nigra*, L. PLANTEFOL** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 2, pp. 123-126).—Six phenols in different concentrations were tested regarding their toxicity as affecting the growth of *S. nigra*. The results are tabulated and discussed.

**Copper fungicidal sprays, MR. and MRS. G. VILLEDIEU** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 10, pp. 707-709).—Having shown, as claimed in contributions previously noted (*E. S. R.*, 48, p. 456), that rain water may not completely dissolve traces of copper present in the neutral or alkaline sprays actually employed in viticulture, the authors maintain that all the ordinary sprays derive their effectiveness from simple solution of the calcium or sodium salts.

**Control of fungus diseases of cereals, E. SCHAFFNIT** (*Landw. Jahrb.*, 57 (1922), No. 2, pp. 259-283).—The present contribution includes studies on wheat stinking smut; fusarium infected rye; barley leaf stripe; evaluation of the chemicals tested; control studies on barley and oat smuts; smut spore germination studies after treatment with Germisan; and the influence of growth-hindering or growth-favoring factors on infection by wheat stinking smut. The work is presented in tabular and descriptive detail, with discussion.

**Prevention of bunt and smut** (*Jour. Min. Agr. [Gt. Brit.]*, 28 (1921), No. 8, pp. 730-732, pls. 2, fig. 1).—The wheat crop of 1921 in England was largely ruined by bunt or stinking smut due to neglect as regards previous seed management. Treatments are outlined as found locally effective against wheat bunt (*Tilletia tritici*) and smuts of oats and barley.

**A safe method of preventing bunt in wheat, E. S. SALMON and H. WOBMALD** (*Jour. Min. Agr. [Gt. Brit.]*, 29 (1922), No. 8, pp. 722-728).—Field experiments, following up those previously noted (*E. S. R.*, 46, p. 742), show clearly that by the use of a very dilute solution (1:480) formalin gives a simple, safe, and cheap method for the prevention of bunt. The solution is slowly sprinkled over the seed wheat at the rate of 1 gal. to 2 bu., the seed being thoroughly stirred meanwhile. The seed is then heaped and covered with sacks, wet with the solution but not dripping. The treated seed is left covered for four hours



only, then spread out thin on a clean floor to dry, with precautions to prevent reinfection. The treated seed after drying should be sown as soon as possible.

It appears that a method involving the immersion of the seed wheat and skimming off the bunted grain, or the use of machinery for this purpose, is unnecessary.

**Resistance of oat varieties to blade blight, Å. ÅKERMAN** (*Nord. Jordbrugsforsk.*, 1923, No. 2, pp. 40-61).—Over 200 plat tests were made in 1921-22 with varieties of oats, including many common and newly originated varieties, together with numerous crosses to determine their comparative resistance to blade blight.

Among the varieties and strains tested in 1921 at Svalöf, the following were graded on June 6 as highest in resistance to the disease: Gul Näsgård; 01174, a Seger and Näsgård cross; Perle; Melog I; Melog III; Norrbotten Early White; 01004 Fyris; and 01004 Gråkornig, a Fyris strain. The comparison made at Svalöf in 1922 indicated that the varieties and strains showing the greatest resistance in June, 1922, were Strube Schlanstedt; Gul Flandrisk; Weibulls Fortuna; Weibulls Eko; Perle; Moistad 505; Melog III; 01262, a cross between Fyris and Klock II; 01004 Fyris and 01004 g Gråkornig; a Guldregn and Tysk Moss cross; 0670, a strain of Tysk Moss; and a strain of Norrbotten.

The susceptibility to the disease was studied in 1921 in a series of lines derived from crosses between Nova and Klock II, and Nova and Klock III. The range between susceptibility and resistance was found to be wider in these lines than in the parent varieties. Some lines were attacked freely by the disease, while others remained untouched. The results showed that the transmission of resistance was irregular, and it was concluded that inheritance of resistance probably is determined by several factors of similar and cumulative effect.

**Breeding oats resistant to stem rust, F. GRIFFEE** (*Jour. Heredity*, 13 (1922), No. 4, pp. 187-190, figs. 3).—The method used at the Minnesota Experiment Station for differentiating heterozygous and homozygous  $F_2$  plants in breeding for rust resistance when resistance is a dominant character is to grow in the greenhouse  $F_3$  seedling families from each resistant  $F_2$  plant. These seedlings are inoculated with rust, and from their reaction the  $F_2$  plants which are homozygous for resistance are determined. In breeding oats resistant to stem rust, 192 of the 567  $F_3$  families thus tested bred true for resistance, thereby reducing the number of lines to be grown in the field the following season accordingly.

The brushing method, in which the seedlings are sprayed with water and then brushed with rusted seedlings, was highly satisfactory for producing inoculum, and may be used as a means of inoculating hybrid families when the manner of reaction allows the segregation to be easily determined.

**Studies on the helminthosporiose of the rice plant, Y. NISIKADO and C. MIYAKE** (*Ber. Ōhara Inst. Landw. Forsch.*, 2 (1922), No. 2, pp. 133-196, pls. 7).—One of the most serious rice diseases in Japan, due to the fungus *Helminthosporium oryzae* and found on all parts of the rice plant in all stages of development, was studied biometrically as to the conidia formed on the host and various media, and the range of variation in size of the conidia was determined. The fungus is readily cultured on almost all kinds of media, morphological variation occurring when different kinds of media are used. The fungus is capable of infecting many species of grasses, causing brownish leaf spots within a few days.

Susceptibility of conidia of this fungus to various chemical substances was tested, and the conidia found to be very susceptible to solutions of copper



sulphate, corrosive sublimate, silver nitrate, calcium hypochlorite, and formalin, these chemicals serving for the purpose of seed disinfection against this disease.

The minimum germination temperature of conidia is 2° C., the maximum 41°. The optimum for germination and mycelial growth seems to be 25 to 30° (77 to 86° F.). The thermal death points in the case of exposures for 10 minutes are 50 to 51° for conidia and 48 to 50° for mycelium.

The fungus is viable in culture as long as 943 days, the conidia as well as the conidiophores serving as sources of early infection.

**Investigations on potato cultivation in western India, H. H. MANN ET AL.** (*Bombay Dept. Agr. Bul.* 102 (1920), pp. 111+145, pls. 9).—This bulletin, in 12 parts with appendix, consists in a description, based on a personal survey, of the conditions as found in the several areas and of the difficulties and deficiencies revealed. An account is given also of former and recent experimentation. The potato has been studied as to cultivation and conditions, especially regarding diseases in the several centers named.

**Further investigations on the Fusarium blights of potatoes in western India, H. H. MANN and S. D. NAGPURKAR** (*Agr. Jour. India*, 17 (1922), No. 6, pp. 564-576).—In a part of the contribution above noted, it is shown that dry-rot forms by far the dominant disease of stored potatoes in India, seed potatoes from every part of the country being badly affected and the amount present being so great that storage in Poona in cold weather for two months at 80° F. means the loss of more than 80 per cent. The provisional result as regards dry rot included in the report required confirmation, and the experiments herein detailed were designed to throw more light on this disease.

This work, as detailed, emphasizes the importance of infected seed as the principal source of continued infection. The soil may also convey the infection, but apparently it must be actually mixed with potato tubers containing the disease if it is to infect a new crop. The soil remains infective for 9 months at least, but after 12 months it is probably not able to infect sound seed potatoes. Experimentation directed to modes of attack seems to show that the disease rarely, if ever, passes directly from one tuber to another, even when they are cut, but if the caterpillar of the potato moth (*Phthorimaea operculella*) is present in the stored tubers infection easily takes place. The opinion held by the potato growers that potatoes affected by dry rot germinate more quickly than others is confirmed.

While the khokha (dry rot) form of the disease leads to complete rotting of the tubers, that occurring as a ring in the potato does not by any means always do so and may exist in a stock of seed potatoes without being detected at all, or at least only at the time of cutting the sets. Thus it may pass on from generation to generation.

**Potato degenerescence and its control, SCHIRBAUX ET AL.** (*Compt. Rend. Acad. Agr. France*, 9 (1923), No. 3, pp. 95-99).—This account deals with diseases and protective measures indicated, noting with discussion the critical potato situation marked in part by the weather during the period 1920-1921, and emphasizing the relative efficacy of so-called individual selection over mass selection. These methods as here indicated both deal, during growth, with potato plants arising from mother tubers apparently sound when planted; but mass selection removes the plants which show disease, retaining to cropping time the more productive, while individual selection removes the defective individuals about the end of June and again goes over the same ground about the middle of September, that is, twice during a period of vegetative growth. The second years' results confirmed practically and con-



clusively the theoretically great relative efficacy of the so-called individual selection.

[Potato diseases], V. DUCOMET (*Compt. Rend. Acad. Agr. France*, 9 (1923), No. 3, pp. 105-109).—Concerning the 73 potato varieties cultivated in 1921 from various localities and 107 varieties cultivated in 1922, both at the Grignon national experimental center, it is stated that the actual productive value of a variety is found to be practically a function of the resistance of the tuber to the transmission of disease. Verticilliose and rhizoctoniose play their part, but the gravity of the loss is due mainly to the so-called degenerescence diseases, leaf roll and leaf curl, which by their severity and wide distribution have determined the great differences observed in potato vigor and yield.

No variety fully resistant was found, though certain varieties proved to be more receptive to one phase of disease than to the other, and certain soils appeared to predispose the crop to one disease or the other.

The results, as detailed, of mass and individual selection, commenced in 1921 and continued during 1922, show that the first method does not give absolute control in one year, and that individual selection, though preferable, must be extended to a considerable number of groups though restricted to the best lots.

It is not unusual to note very rapid decline in an unselected strain. The apparent quality of a strain is to be distinguished from its actual value, but only through knowledge of its progeniture.

A new fungus parasitic on rush, M. KASAI (*Ber. Ōhara Inst. Landw. Forsch.*, 2 (1922), No. 2, pp. 225-232, pls. 3).—Rush (*Juncus effusus decipiens*), in Japan a useful and technically valuable material principally in the mat industry, is subject to a stem disease. This has been recently recognized and is here described as due to a new fungus, *Cercosporina juncicola*, a formal description of which is given.

Concerning the sugar cane root parasite, *Aeginetia indica*, F. P. McWHORTER (*Philippine Agr.*, 11 (1922), No. 3, pp. 89-90, pl. 1).—In sugar cane growing regions of the Philippines the broom rape root parasite (*A. indica*) is yearly becoming a more serious pest. Attention is called to the work of Kusano (*E. S. R.*, 20, p. 1126) dealing with the life history of the parasite.

Control measures recommended on the basis of studies by the author, as well as those by Kusano, include complete destruction of affected plants, and rotation. Development of resistance does not appear feasible, as the parasite is not even confined to the genus *Saccharum*.

[Fungi causing disease of tobacco in Brazil], R. AVERNA-SACCÁ (*Bol. Agr. [Sao Paulo]*, 23. ser., No. 7-8 (1922), pp. 201-268, figs. 31).—As parasitic fungi causing diseases of tobacco, the author lists, with brief discussion, *Phytophthora nicotianae*, *Uredo nicotianae*, *Pleospora nicotianae* n. sp., *Macrophoma tabaci* n. sp., *Phoma solanicola*, *Cytospora nicotianae*, *Placosphaeria nicotianae* n. sp., *Lasiodiplodia theobromae*, *Colletotrichum nicotianae* n. sp., *Erysiphe cichoriacearum*, *Thielavia basicola*, *Cercospora nicotianae*, *C. solanicola*, *Alternaria tenuis*, *Nectria cinnabarina*, *Verticillium albo-atrum*, and *Sclerotinia libertiana*, with others found in dead leaves. Mosaic is discussed as to its possible causation and similarities or relations to other diseases.

The influence of fruit tree chlorosis on the chemical composition of the fruits, G. RIVIÈRE and G. PICHARD (*Jour. Soc. Natl. Hort. France*, 4. ser., 23 (1922), May, pp. 192-194).—Of two pears, one from a tree showing chlorosis, the other from a tree of the same age fully recovered from that condition as a result of treatment (injection) with iron sulphate, the latter showed considerably increased total weight and content of saccharose, glucose, total sugar, ash (9:1), and iron, but slightly less acidity.



**Origin and control of apple-blotch cankers**, M. W. GARDNER (*Jour. Agr. Research* [U. S.], 25 (1923), No. 10, pp. 403-418, pls. 3).—In a previous publication (E. S. R., 49, p. 754) it was suggested that a large percentage of cankers on twigs are the result of invasions of the fungus (*Phyllosticta solitaria*) from infected petioles. In the present publication evidence is presented to substantiate this claim, and the results of experiments for its control, particularly on twigs and stems of apple trees, are summarized. The recommendations for control are the same as those previously given.

**Apple blotch control**, M. W. GARDNER (*Ind. Hort. Soc. Trans.*, 1921, pp. 184, 185).—In a summary of a paper presented at the fruit growers' short course at Purdue University in February, 1921, it is stated that apple blotch was gradually spreading northward. It is advised that in planting new orchards such susceptible varieties as Northwestern Greening and infected nursery stock should be avoided. As a preliminary to spraying, pruning to open up the top and to eliminate diseased wood is recommended.

**Diseases of stone fruits in British Columbia**, J. W. EASTHAM (*Brit. Columbia Dept. Agr., Hort. Branch Circ.* 52, 2. ed. (1921), pp. 7, figs. 5).—The stone fruit diseases here listed with brief discussion, include peach leaf curl, peach mildew, brown rot of stone fruits, shot hole, and gummosis.

**Spore germination in grape mildew**, L. RAVAZ and G. VERGÉ (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 25, pp. 1421-1423).—The emission and germination of spores of grape downy mildew (*Plasmopara viticola*) are closely dependent upon conditions of the medium which are outlined as subject to narrow limitations.

Lime, becoming carbonated, rapidly loses its fungicidal quality. Copper-lime fungicides resist for a considerable time the influence of rain or of dew and furnish protection by hindering germination of mildew spores.

**Die-back of orange**, G. CHEEMA (*Bombay Dept. Agr. Ann. Rpt.* 1921-22, p. 131).—Die-back of citrus fruits in Bombay Presidency is observed to be due to insufficient root exposure and excessive manure, water logging conditions, shallow soil, and fungus diseases (*Diplodia*).

**Fungi fatal to the coffee berry beetle**, K. FRIEDERICHS and W. BALLY (*Meded. Koffiebessenboek Fonds [Java]*, No. 6 (1923), pp. 103-147, pls. 5, figs. 2).—The presence of one or more fungi attacking and reducing, as regards numbers, the coffee berry beetle, *Stephanoderes hampei* (*S. coffeae*), has been observed for several years in Java. Two such fungi have now been found by the authors in this work and are technically described as new species, being named, respectively, *Botrytis stephanoderis* and *Spicaria javanica*. Experimentation regarding the effective natural spread of these fungi has not yet proved successful, though where present they lower the production of young beetles.

**Mosquito blight of tea**, [R. D. ANSTEAD and E. BALLARD] (*Planters' Chron.* 17 (1922), No. 30, pp. 443-447).—Tea mosquito blight is here treated as a product and symptom of conditions unfavorable to the health of the tea bush. These conditions are outlined along with experiments looking to remedial measures, in particular the effect of applying to the soil continually small doses of potash under various conditions combined with liming and drainage. In Assam, results begin to show after a period of two or three years.

**A threatening date palm disease in Moroccan oases**, E. SERGENT and M. BÉGUET (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 25, pp. 1624-1627).—Date palms in certain oases of Morocco show a disease characterized in part by leaf scorch and gumming of the vascular system, the infection apparently traveling upward from the roots.



**Recent biological studies on mallow rust**, J. ERIKSSON (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 20, pp. 925-928).—Having studied mallow rust (*Puccinia malvacearum*) during 20 years and having in 1911 summed up the previous studies in a comprehensive note (E. S. R., 25, p. 850), the author now gives a résumé of the work and results during the latter half of the period.

The more recent work has shown that the fungus produces two spore forms which differ from a biological viewpoint. In Sweden one of these forms appears in September or October on young hollyhock grown from seed sown about June. It also appears during August-October on plants which have survived the preceding winter, if these belong to a diseased line. These are called the autumn spores. Those of the other form appear during certain years in spring and summer (May-July) on hibernated plants. These are the summer spores, and they germinate in one of two ways, according to the author. At the bottom of a drop of water they germinate to form long, slender, thin filaments the extremities of which break up into conidia; at the surface or in moist air they form short, thick, curved promycelia, producing sporidia. The summer spores, however, always germinate in one fashion, producing long filaments and conidia. The behavior of all these spores is shown in tabular form, as is also that of diseased or sound hollyhock lines at Stockholm during the period 1912-1920.

**The diseases of rubber [in India]**, (*Planters' Chron.*, 17 (1922), No. 4, pp. 57-60).—Reports of the deputy director of agriculture and of the rubber mycologist for November and December, 1921, are drawn upon for information, which is presented in condensed form, regarding die-back, brown bast, and patch canker of young Hevea.

**A consideration of recent work on the brown bast problem**, A. SHARPLES (*Malayan Agr. Jour.*, 10 (1922), No. 6, pp. 155-170).—Brief accounts are given of attempts to isolate a disease organism from brown bast areas, of tapping experiments suspected of causing the trouble, and of attempts at control.

Brown bast is most probably physiological, and is increased enormously by heavy tapping. Under a very heavy tapping system (as in the full spiral plan) alternate day tapping shows a lower brown bast rate than does an area tapped daily. Further information appears below.

**Preliminary report on brown bast experiments in Malaya**, A. SHARPLES and L. LAMBOURNE (*Malayan Agr. Jour.*, 11 (1923), No. 2, pp. 30-35).—Experimental work is outlined as indicating the physiological character of Hevea brown bast. Its sudden and abnormal development would indicate a close association of the disease with high yields, and it is considered as almost certain that this trouble will act as a limiting factor in yield. It appears most probable that brown bast is to be considered as a feature associated with exhaustion.

**Estate treatment of moldy rot**, A. S[HARPLES] (*Agr. Bul. Fed. Malay States*, 9 (1921), No. 4, pp. 277, 278).—Trials with various disinfectants are indicated. It is said that, after treating moldy rot with Agrisol for five months, it is believed that the disease can be kept under control by painting the trees every 10 days with a 20 per cent solution. One of the main advantages of this operation is that no extra labor is required for its application. During this experiment the trees were painted every 12 days, but the period was afterwards reduced to 10 days.

The cost of the treatment works out at 10.25 cts. per acre per month. Agrisol does not appear to have any injurious effect on the tree scrap or bark.

**Final report on treatment of moldy rot disease with Agrisol**, A. SHARPLES (*Malayan Agr. Jour.*, 11 (1923), No. 2, pp. 36, 37).—Efficient control of moldy rot



and clean tapping surfaces at low cost are the indicated results of treatments carried on during 18 months, as partly reported above. The complete eradication of the disease is considered impracticable.

**Distribution of pink disease in Federated Malay States mukims, 1920,** F. W. S[OUTH] (*Agr. Bul. Fed. Malay States*, 9 (1921), No. 4, p. 279).—Reports on the distribution of pink diseases for 1920 show that a general improvement has been accomplished, but that the disease is still prevalent in Perak, and particularly so in Ulu Selangor.

**The possibility of control of *Heterodera radicum* and other plant-injurious nemas by means of predatory nemas, especially by *Mononchus papillatus*,** G. STEINER and H. HEINLY (*Jour. Wash. Acad. Sci.*, 12 (1922), No. 16, pp. 367–368, figs. 10).—The investigations here noted were carried on during the period December, 1921, to May, 1922, in the Osborn Zoological Laboratory of Yale University, in collaboration with the U. S. Department of Agriculture, after having been outlined by Cobb, who is credited with having originally pointed out (*E. S. R.*, 38, p. 254) the possibility of using predatory nematodes in suppressing the kinds injurious to plants.

For the present investigation the authors chose *M. papillatus*, this species being very common, easy to obtain, and voracious. Simple and practicable methods of rearing mononchs were sought. The life history studies with *M. papillatus* showed that the life of this form may be of considerable length, this fact suggesting the same in connection with injurious soil nematodes. Hermaphroditism, being present in all members of this species, is regarded as of some importance in the present problem. Three molts were noted, the last one just preceding sexual maturity and egg production. The senile stage (after egg production) was of relatively long duration, lasting in one case 10 weeks, as contrasted with 8 weeks for the combined length of the preceding periods. The maximum life in slide cultures was 18 weeks, the tube cultures living much longer.

In the larval stage the animals apparently devour soil particles, the intestine then approaching brownish or black, but they soon begin to feed on other nematodes, attacking Rhabditis (larvae) at the age of three days, and increasing the number from one or two daily to 65 or more, and in one case to 83 nematodes (*H. radicum*). One mononch killed 1,332 nematodes during its lifetime of about 12 weeks. The number would probably be larger under natural conditions.

The organs of touch, only, appear to be employed by *M. papillatus* in hunting its prey, though organs may be possessed for chemical or chemico-physical perception, as well as organs for the perception of light. *M. papillatus* can not find its prey at long distances. The mononch, once in contact with its prey, attaches itself firmly thereto by a sucking movement, probably of the esophageal muscles. The spear or tooth attached on the dorsal wall and capable of being retracted or protruded caused a wound, through which a stronger sucking action removes more or less of the body fluids. In one case an entire nematode was observed to be taken in, apparently without being wounded. The mouth cavity serves apparently as a suction capsule and not for maceration. The tooth is protruded during the swallowing of a whole animal. The contractions of the strong radial muscles were very vigorous. Some of the digestive fluids are probably secreted by glandular cells along the radial muscles of the esophagus. Digestion, however, apparently begins and ends in the intestines.

*H. radicum* is devoured in large numbers, this species being alone sufficient to support the predatory mononch. Once in the roots these food nematodes are probably safe from their enemies, the mononchs; but when moving freely



in the soil during larval life, they may be destroyed in numbers sufficiently large to secure control of the plant-injurious forms under favoring conditions. Knowledge of conditions and happenings in natural soil is at present very limited.

### ECONOMIC ZOOLOGY—ENTOMOLOGY.

**Laws relating to fur animals for the season 1923-24**, G. A. LAWYER and F. L. EARNSHAW (*U. S. Dept. Agr., Farmers' Bul. 1387 (1923), pp. II+34*).—This is the ninth annual summary of the laws relating to fur animals (*E. S. R.*, 48, p. 51).

**The birds of Cuba**, T. BARBOUR (*Mem. Nuttall Ornithol. Club, No. 6 (1923), pp. 141, pls. 4*).—The first part of this work consists of an introductory account in which the history of bird studies in Cuba, ornithological collections, geography and geology, and climate are considered. This is followed (pp. 23-130) by an annotated list of 273 forms recognized as occurring in Cuba.

**A bibliography of British ornithology from the earliest times.—Sup., A chronological list of British birds**, H. K. SWANN (*London: Wheldon & Wesley, Ltd., 1923, pp. XVII+42*).—This supplement to the work previously noted (*E. S. R.*, 39, p. 555) lists chronologically the genera, species, and subspecies of birds of Great Britain.

**The natural history of South Africa: Birds**, F. W. FITZSIMONS (*London and New York: Longmans, Green & Co., 1923, vols. 1, pp. XVI+288, pls. 5, figs. 172; 2, pp. VII+323, pls. 5, figs. 99*).—The first of these two volumes consists of a popular account of the birds of South Africa. The second includes a list of South African birds and their diet (pp. 1-63), followed by descriptions, distribution, and habits of the birds (pp. 65-196) and a systematic list of the birds of South Africa (pp. 197-323). An account of the mammals of South Africa has been noted (*E. S. R.*, 44, p. 348).

**The common birds of India**, D. DEWAR (*Calcutta: Thacker, Spink & Co., 1923, vol. 1, pts. 1, pp. VIII+44, pl. 1, figs. 15; 2, pp. 45-90, figs. 19; 3, pp. 91-126, figs. 10*).—This volume, illustrated by G. A. Levett-Yeats, deals with the sportsman's birds, including wild fowl, game birds, and pigeons.

**Handbook of zoology: A natural history of the classes of animals**, I. W. KÜKENTHAL ET AL. (*Handbuch der Zoologie: Eine Naturgeschichte der Stämme des Tierreiches. Berlin: Walter de Gruyter & Co., 1923, vol. 1, No. 1, pp. [2]+192, figs. 184*).—In this first fascicle the Protozoa (pp. 1-51) and the Rhizopoda (pp. 51-114) are dealt with by L. Rhumbler, the Flagellata by V. Jollos (pp. 115-185), and the Sporozoa (in part) by M. Hartmann (pp. 186-192).

**The H-ion concentration of the soil and of natural waters in relation to the distribution of snails**, W. R. G. ATKINS and M. V. LEBOUR (*Roy. Dublin Soc. Sci. Proc., n. ser., 17 (1923), No. 25-31, pp. 233-240, figs. 2*).—"The H-ion concentration of the soil is a factor limiting the distribution of snails. Snails are more numerous at pH7-8 than they are elsewhere. The number of species of snails found in the districts studied increases from pH5-4 species to pH7-20 species, falling at pH8 to 14 out of the total 27 species found. Snails with hyaline shells may be found in any portion of the range, but those with calcareous shells are limited to the more alkaline end. Granite and quartzite regions have few species, basaltic districts have a more numerous fauna, and in limestone areas both species and numbers of individuals give high values. There remain over a number of puzzling cases in which, within an area of 2 square miles, certain species are altogether absent from one locality, though abundant in others, in spite of similarity in pH value, salt content (as shown by electrical conductivity measurements of soil extracts), and aspect. A difference only in exposure to wind could be noted. The distribution of some species



within the British Isles is probably explained by the 'Age and Area' theory of Willis rather than by a limitation through unfavorable ecological factors. *Cochlicella barbara* appears to have a western and *Theba cantiana* an eastern origin."

**On the free-living larval stages of the nematode *Bunostomum trigonocephalum* (Rud.), a parasite of sheep, A. J. HESSE** (*Jour. Helminthol.*, 1 (1923), No. 1, pp. 21-28, figs. 3).—With eggs kept in water and feces at 22° C. (71.6° F.) the larvæ hatch out in 24 hours or are in the process of hatching out. The first stage larvæ become quiescent after 24 hours at a temperature of 22 to 23°, and 24 hours after the first molt the second takes place. Like the larvæ of *Haemonchus contortus*, *Graphidium strigosum*, and *Trichostrongylus retortaeformis*, they can withstand desiccation for an indefinite time. The free-swimming "filariform" stage can survive in stagnant water for a long time. Under natural conditions the larvæ are probably ingested by the sheep in the moisture on grass or after they have become dried on blades of grass. The author's observations indicate "that the larvæ of *B. trigonocephalum* do not migrate up blades of grass like the ensheathed forms of *H. contortus*. Their position on the grass is a matter of chance, and they simply remain in some hollow or loop in a blade of grass as the water evaporates."

**Spirochetosis icterohemorrhagica, KIRKWOOD and HORNING** (*Vet. Med.*, 18 (1923), No. 10, pp. 936, 937).—The authors report upon autopsies and microscopical examinations made of the lesions of 5 dogs and blood examinations of 10 of 40 cases of sore mouth, Stuttgart's disease, or canine typhus which occurred in a large kennel at Houston, Tex., in 1919. They were able to demonstrate the spirochete in the mouth lesions of 3 of the 5 dogs, in the bladder and secretions of macerated kidneys of all of them, and in the blood of 3 living cases. The spirochete was also demonstrated in the urine, pipetted direct from the bladder and centrifuged, and macerated kidneys of 9 of 11 rats found and destroyed on the place. It is stated that while the mortality has not often exceeded 10 per cent, some outbreaks have been reported in which it was as high as 45 per cent. In a discussion of treatment, it is pointed out that the extermination of rats is an important factor in its prophylaxis.

**The life of Jean Henri Fabre, the entomologist, 1823-1910, A. FABRE**, trans. by B. MIALL (*New York: Dodd, Mead & Co., 1923, pp. XIV+398*).—This is a translation of the French edition, issued in 1910.

**External insect anatomy, A. D. MACGILLIVRAY** (*Urbana, Ill.: Scarab Co., 1923, pp. VIII+388, figs. 142*).—This is a guide to the study of insect anatomy and an introduction to systematic entomology, based upon studies commenced in 1911. The several chapters deal with the fixed parts of the head (pp. 24-68), movable parts of the head (pp. 69-151), thorax (pp. 152-209), abdomen (pp. 210-241), legs (pp. 242-272), and the wings (pp. 273-363), respectively, followed by a list of the species described (pp. 364-368) and a subject index.

**Social life among the insects, W. M. WHEELER** (*New York: Harcourt, Brace & Co., 1923, pp. VII+375, figs. 116*).—This work consists of a series of lectures, delivered at the Lowell Institute in Boston in March, 1922, and dealing with the subject as follows: General remarks on insect societies—the social beetles (pp. 3-41); wasps solitary and social (pp. 43-89); bees solitary and social (pp. 91-145); ants, their development, castes, nesting, and feeding habits (pp. 147-194); parasitic ants and ant guests (pp. 195-235); and the termites or white ants (pp. 237-283). An annotated list of references to each of the lectures, designated as a documentary appendix, is included (pp. 285-355), together with subject and author indexes.

**The principles of insect control, R. A. WARDLE and P. BUCKLE** (*Manchester: Univ. Press; New York: Longmans, Green & Co., 1923, pp. XVI+295, pl.*



1, figs. 32).—Part 1 of this work, on biological control, takes up host resistance (pp. 1–16), climatic restraints (pp. 17–31), disease (pp. 32–42), parasites and predators (pp. 43–56), and bird encouragement (pp. 57–70); part 2, on chemical control, deals with insecticides (pp. 71–117), dips and dressings (pp. 118–133), attractants and repellents (pp. 134–143), and fumigants (pp. 144–159); part 3, on mechanical control, deals with cultural methods (pp. 161–166), restriction of spread (pp. 167–191), crop storage (pp. 192–204), and baits and traps (pp. 205–219); and part 4 is devoted to legislative control (pp. 221–228), followed by an appendix dealing with machinery (pp. 229–249), an extensive bibliography arranged by chapters (pp. 251–276), and a general index.

Some principles which underlie the making and the use of nicotin dust, T. J. HEADLEE and W. RUDOLFS (*New Jersey Stat. Bul.* 381 (1923), pp. 5–47, figs. 18).—This is a report of investigations commenced in 1921, in which year the insecticidal qualities of different nicotin dusts were tested on the apple aphid, and continued in 1922, when field tests were made on the pea aphid (*Macrosiphum pisi*), the pink and green aphid of the potato (*M. solanifolii*), the onion thrips, and the green peach aphid on pepper. The bulletin is divided into five parts: Part 1 (pp. 6–9) reports field work of 1921, part 2 (pp. 9–29) a study of the evolution of nicotin gas from various types of carrying substances, part 3 (pp. 29–33) a laboratory study of plant louse kill by nicotin gas evolved from nicotin dust, part 4 (pp. 34–43) field work of 1922, and part 5 (pp. 43–46) consists of a general discussion of results.

The authors' conclusions drawn for carriers impregnated with nicotin sulphate are as follows: "Great differences occur in delivery of nicotin from different clay carriers. The evolution of nicotin from mixed mineral carriers is superior to nicotin evolution from acid colloidal clay carriers. Pure crystalline carriers evolve more nicotin than colloidal carriers provided the size of the particles of the crystalline carriers are not too small. Nicotin delivery from all carriers becomes gradually less rapid. The evolution of nicotin is mainly dependent upon chemical reactions. Physical factors like surface tension are involved. Nicotin delivery responds to chemical 'activators,' carbonates ( $\text{CaCO}_3$  plus  $\text{MgCO}_3$ ) giving best results. There exists a relation between free acidity and alkalinity of the carriers as expressed in pH values and the nicotin delivery. . . . Atmospheric moisture conditions influence nicotin delivery to a large extent (acceleration from carbonate carriers by certain amounts of atmospheric moisture, retardation from carriers without chemical activators). More nicotin is evolved under influence of high temperatures than of low temperatures."

For carriers impregnated with free nicotin the conclusions drawn are as follows: "The quantity of nicotin delivered differs with the different clay carriers. Less nicotin evolves from colloidal carriers than from pure crystalline carriers provided the particles of the latter are not below a certain size. The rapidity of nicotin evolution becomes gradually less from all carriers. No chemical reaction but some physical factors are involved in the nicotin evolution. Nicotin delivery from different crystalline carriers with and without chemical activators is nearly alike, compactness or structure of the carrier playing a rôle. An increase in atmospheric moisture retards nicotin delivery."

The authors conclude further that "magnesium limestone (dolomite) is an effective carrier for nicotin sulphate, is cheap and convenient to purchase, does not burn plants, and has good adhering qualities. It makes a good dust for ground crops. Hydrated lime with 10–30 per cent dolomite impregnated with nicotin sulphate can be used to advantage for orchard dusting."

The authors consider it well demonstrated that nicotin dusts kill by reason of the gas which evolves from them, and that a dust which rapidly volatilizes



the largest possible percentage of its nicotin content is the best dust for use against plant lice affecting vegetable crops. The period of reduction in numbers of plant lice following application is variable and may range from 24 to 72 hours, depending upon the rapidity with which the lice are reproducing. Anything, such as low temperature, dew, or rain, which interferes with the evolution of the nicotin gas during that period following application in which the kill takes place reduces the efficiency of the material. Temperature is an important factor. Killing may be obtained at as low as 60° F., but increases very rapidly as the temperature increases.

A list of 22 references to the literature is included.

**Insecticides and fungicides**, H. L. FULMER (*Ontario Dept. Agr. Bul.* 302 (1923), pp. 48, figs. 4).—This summary of information on insecticides and fungicides is a revised edition of Bulletin 195, previously noted (E. S. R., 26, p. 840).

**Report on the occurrence of insect pests on crops in England and Wales for the years 1920–1921** ([*Gt. Brit.*] *Min. Agr. and Fisheries, Misc. Pub.* 39 (1923), pp. 40, pls. 2).—The first chapter of this account (pp. 5–13) consists of a special account of insects of general importance, etc.; chapter 2, compiled by F. V. Theobald (pp. 14–20), deals with aphids on fruit; and chapter 3 consists of a tabulated summary of insect pests, their occurrence and injury.

**Report of the entomologist** (*Expt. and Research Sta., Cheshunt Herts., Ann. Rpt.*, 8 (1922), pp. 45–57).—This report on the control of insect pests of greenhouses deals particularly with wood lice, red spider, and fungus gnats. The wood lice recorded as pests in cucumber houses are *Armadillidium speyeri* Jack, and *A. pictum* Br. and in the tomato houses *Porcellio laevis* Lat., *A. vulgare* Lat., and *Haplophthalmus danicus* Lund.

[**Contributions on economic insects**] (*Ztschr. Angew. Ent.*, 9 (1923), Nos. 1, pp. 189, figs. 20; 2, pp. 190–434, pls. 2, figs. 58).—The papers presented in No. 1 of this volume (E. S. R., 47, p. 551) relating to insects of economic importance include the following: A Contribution to the Knowledge of *Tipula oleracea* L., with a bibliography of 11 pages, by F. Bodenheimer (pp. 1–80); Means of House Fly Control, with a bibliography of 37 titles, by W. von Schuckmann (pp. 81–104); The Migratory Locust in the Kuban Department (Caucasus) in the Years 1920 and 1921, by C. Bogdanov-Katjkov (pp. 105–110); The Hymenopterous Parasites of the Frit Fly (*Oscinosoma frit* L.), by R. Meyer (pp. 111–120); Mosquitoes and the Drought of 1921 (pp. 121–132) and Determination of the Longevity of the Insect Pests as Based on the Anopheles Investigations of Von Schüffner and Von Grassi (pp. 133–146), both by E. Martini; A Contribution to the Biology of *Sciara militaris*, by O. Freudling (pp. 147–151); and A Review of the Literature on Bark Beetles, which includes a bibliography of 15 pages, by R. Kleine (pp. 165–180).

The papers of economic importance in No. 2 include the following: A Contribution to the Knowledge of *Lecanium hesperidum* L., Particularly Its Biology, with bibliography of 82 titles, by M. Dingler (pp. 191–246); Zoological Meteorological Studies.—First Contribution, The Influence of Station and Climate on the Gradation of *Bupalus piniarius* L., by F. Eckstein (pp. 247–305); On the Knowledge of *Agrotis segetum* Schiff.—III, Enemies and Diseases, with a bibliography of 44 titles, by W. Herold (pp. 306–332); A Contribution to the Biology of the Rice Weevil (*Calandra oryzae* L.), by J. Wille (pp. 333–342); Modern Insect Control in the United States, by I. C. T. Uphof (pp. 343–352); Notes on the Control of *Ips typographus*, by F. von Schollmayer-Lichtenberg (pp. 353–364); *Ips cembrae* as a Permanent Pest, by Nechleba (pp. 365–368); *Lophyrus pallipes* Fall., a Previously Little-known Forest Pest (pp. 369–389)



and A Hitherto Little-known Leaf Roller, *Rhynchitis (Deporaus) tristis* Fab. (pp. 390-394), both by F. Scheidter; and The European Species of Genera Close to *Monodontomerus* Westw.: Chalcidid Studies, IV, by F. Ruschka (pp. 395-408).

**Work of the entomologist, A. H. KIRBY** (*Tanganyika Ter. Dept. Agr. Rpt. 1922, pp. 19-21*).—This brief account, taken from a detailed report by the entomologist, A. H. Ritchie, deals with coconut and sisal pests, cotton pests, locusts, etc.

**The insects of the soy bean in Ohio, W. V. BALDUF** (*Ohio Sta. Bul. 366 (1923), pp. 147-181, figs. 9*).—This is a summary of information on the insect enemies of the soy bean, a plant rapidly growing in importance as a farm crop in Ohio, based upon observations made near Marietta during the summers of 1919, 1920, and 1921. The studies are said to confirm the common claim that soy beans are comparatively free from injurious insects, even though 209 species were collected on the crop and on the vegetation in the immediate surroundings during the three years. The more important insects associated with the soy bean are briefly considered, particular attention being given to the green clover worm (*Plathypena scabra* Fab.), which, with the increasing acreage of soy beans, has caused serious losses in Virginia, North Carolina, and neighboring States, though of only minor importance as yet in Ohio. The insect ecology of the soy bean is briefly discussed, and descriptions and diagrams are given of the stations studied, followed by a list of species taken in the stations, with the dates and abundance of the same. A brief summary with conclusions is followed by a list of 26 references to the literature.

**Some important enemies of the apple and their parasites, R. REGNIER** (*Rev. Bot. Appl. et Agr. Colon., 3 (1923), No. 19, pp. 169-185, fig. 1; abs. in Rev. Appl. Ent., 11 (1923), Ser. A, No. 6, pp. 295, 296*).—This is a general account of the insect pests of the apple in France, their natural enemies, etc., by the director of the entomological station at Rouen.

**Notes on some insects injurious to forest trees (Bul. Soc. Dendrol. France, No. 48 (1923), pp. 65-116, pls. 13, figs. 4)**.—This paper deals (1) with insects whose attack is confined exclusively to conifers (pp. 65-96) and (2) with insects whose attack is exclusively to the foliage.

**Forest insects of Australia, W. W. FROGGATT** (*Sydney: Forestry Commrs. N. S. Wales, 1923, pp. VIII+171, pls. 2, figs. 91*).—The several chapters of this work deal, respectively, with plant galls, the economic value of birds in forests, and insects generally in their relation to forest trees (pp. 4-13); the Termitidae (pp. 14-23); wood-boring beetles that damage timber trees, chiefly hardwood (pp. 24-34); insects of the Eucalyptus (pp. 35-51); insects attacking various species of Eucalyptus, some more than one species (pp. 52-56); stick insects, moths, sawflies, and homopterous insects attacking Eucalyptus (pp. 57-75); insects of the sugar gum, *Eucalyptus cladocalyx* (pp. 76-80); insects of the kurrajongs, *Brachychiton populneum* (pp. 81-88); insects of the humble tree or wild pomegranate, *Capparis mitchelli* (pp. 89-95); insects of the wild lime, *Atlantia glauca* (pp. 96-103); insects of the wattles, genus *Acacia* (pp. 104-110); longicorn beetles of the wattles—other wattle insects (pp. 111-119); Lepidoptera of the wattles (pp. 120-131); other insects of the wattle (pp. 132-134); insects of the red cedar (pp. 135-140); insects of the fig trees (141-147); insects of the Casuarinas (pp. 148, 149); insects of the Banksias (pp. 150, 151); (insects of the *Pinus insignis* (pp. 152-158); insects of the cypress pines (pp. 159-163); and insects of the kauri pines (pp. 164-166).

**Correlation between the food and morphology of termites and the presence of intestinal protozoa, L. R. CLEVELAND** (*Amer. Jour. Hyg., 3 (1923), No. 4, pp. 444-461*).—"Workers of practically all the termites in the U. S. National



Museum have been examined for intestinal flagellates and the results recorded. All species of the Mastotermitidae, Kalotermitidae, and Rhinotermitidae that were examined contained protozoa and wood in their guts. Wood and protozoa were found in the guts of three species of the Termitidae. The correlation, in the castes of a colony and in species, between a strict wood-feeding habit and the presence of intestinal protozoa is perfect and positive. The correlation between structural differentiation (systematic position as determined by morphology) and the absence of intestinal protozoa is not quite perfect (0.9+)."

**The life history of the brown locust, *Locustana pardalina* (Wlk.),** J. C. FAURE (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 3, pp. 205-224, figs. 3).—This is a detailed account of studies of *L. pardalina*.

**Notes on locusts of economic importance, with some new data on the periodicity of locust invasion,** B. P. UVAROV (*Bul. Ent. Research*, 14 (1923), No. 1, pp. 31-39, fig. 1).—This paper deals with Old World locusts of economic importance.

**The digestive system of the periodical cicada, *Tibicen septendecim* L., I-III** (*Ann. Ent. Soc. Amer.*, 13 (1920), No. 2, pp. 223-242, pls. 6; *Biol. Bul. Mar. Biol. Lab. Woods Hole*, 45 (1923), No. 4, pp. 200-228, pls. 4).—The first of these papers on the digestive system of *T. septendecim* deals with the Morphology of the System in the Adult Insect, by L. M. Hickernell (pp. 223-242); the second is a report of the Physiology of the Adult Insect, by C. W. Hargitt (pp. 200-212); and the third is an account of the Morphology of the System in the Nymph, by Hickernell (pp. 213-228). The three parts are accompanied by lists of 7, 10, and 7 references to the literature, respectively.

**The citrus psylla (*Trioza merwei* Pettey),** C. P. VAN DER MERWE (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 2, pp. 135-141).—This is an account of the psyllid previously noted by Pettey (*E. S. R.*, 50, p. 155), which causes the pitting and curling of citrus leaves commonly met with in South Africa. A description is given of its several stages, and accounts of its life history and habits, natural enemies, and control measures. It was found that only the nymphs can be dealt with by a spray, which for best results should be applied before the leaves curl. Since repeated spraying with any miscible oil may cause the leaves to fall, it is thought that the use of resin wash may be advisable.

**Scale insects of Missouri,** A. H. HOLLINGER (*Missouri Sta. Research Bul.* 58 (1923), pp. 3-71, pls. 7).—In this report of studies of the scale insects of Missouri, the author presents keys for the separation of the subfamilies, genera, and species recognized as occurring in the State, together with technical descriptions and discussions of their occurrence, host plants, and importance. Seventy-eight species, representing 26 genera, are recognized as occurring in the State, of which 11 species, representing 6 genera, are described as new. A field key to the coccids found or known to occur in Missouri, intended to facilitate the identification of the species, is given, and a bibliography of 28 references to the literature is included.

**Butterflies and moths and how to know them,** S. C. JOHNSON (*London: Robert Holden & Co., Ltd.*, pp. 128, figs. 86).—This is a small pocket handbook.

**Results of the third year's work against the gipsy moth in New Jersey,** H. B. WEISS, A. F. BURGESS, H. L. MCINTYRE, and H. A. AMES (*N. J. Dept. Agr. Circ.* 67 (1923), pp. 23, figs. 20).—A detailed account of the control and eradication work being conducted with the gipsy moth in New Jersey.

**Tests in control of leaf roller,** P. HARDING (*Better Fruit*, 18 (1923), No. 2, pp. 7, 8, fig. 1).—The author reports that in Utah entire apple crops in some orchards have been lost because of the ravages of the pest in causing unmar-



ketable fruit. He reports upon studies made on Provo Bench, Utah County, where the pest has spread rapidly within the last two years, increasing nearly 100 per cent during the last year.

Tests made of insecticides, which are reported in tabular form, have led to the conclusion that Scalecide was effective until a concentration of 1:17 was reached, less than that (1:20) showing 85 per cent hatching. Dorman Soluble Spray was effective to 1:15, less than 1:20 giving 70 per cent hatch. Dry lime sulphur was ineffective even up to 40 lbs. per 100 gal. The best results were obtained with Target Scale Destroyer, only 0.14 per cent having hatched with as weak a solution as 1:30. Spra-Mulsion gave similar results, 0.24 per cent having hatched with a strength of 1:15.

**The puss caterpillar and the effects of its sting on man**, F. C. BISHOPP (*U. S. Dept. Agr., Dept. Circ. 288 (1923), pp. 14, figs. 12*).—This is a report of studies of *Megalopyge opercularis* S. & A., of the family Megalopygidae, the urticating hairs or spines of which produce the severest sting of any of the 25 species representing some 8 families of Lepidoptera the bodies of the larvae of which are supplied with such spines. The caterpillars of this species sometimes become so numerous in the South as almost to defoliate shade trees, but are of principal importance because of their sting. *M. opercularis* occurs as far north as Virginia, is common in Florida, and is not infrequently met with in the central Southern States, but appears to attain its maximum abundance in Texas, especially from Dallas southward in the central western part of the State. The related species *Lagoa crispata* Pack. is very commonly met with throughout the Northern States, but its stinging propensities are not highly developed. *M. opercularis* has been reported by Watson (*E. S. R.*, 39, p. 557) and others as feeding regularly on citrus trees in Florida, and the author has taken it commonly on hackberry, elm, cultivated and wild plum, sycamore, oak, and rose bushes. Technical descriptions are given of its several stages, followed by a report of observations of its life history and seasonal history, injuriousness, natural control, and remedial measures.

The species passes the winter in the larval stage within the cocoon, pupation taking place in the early spring and the adults emerging from April to June. Eggs are deposited within a few days, which hatch in from 4 to 8 days, and from 30 to 60 days are required for larval development. In Dallas the maximum number of grown larvae of the first generation seem to occur in June and July and of the second generation in September and October. There has always been more or less overlapping of the two generations, however, and in some strains there is probably but a single generation in a year. Pupation of the first or summer generation usually extends through July, ranging from 28 to 41 days. The cocoons of the second generation are spun from September until heavy freezes occur.

A disease caused by *Micrococcus* spp. has caused a high mortality of the larvae. In addition to this disease, and probably of even greater importance, are the tachinid parasites *Exorista flavirostris* v. d. W. and *Phorocera clari-pennis* Macq. Two specimens of *Chalcis ovata* Say were reared from cocoons, and specimens of *Compsocryptus* (*Cryptus*) *retentor* Br. emerged in April from cocoons collected in November. The larvae have been controlled on shade trees in Dallas by the application of 7 lbs. of powdered lead arsenate to 150 gal. of water, with 4 lbs. of dehydrated lime added. About half of the caterpillars were found dead on the ground four days after spraying, and a few days later all had disappeared. A combination contact and poison spray which consisted of an emulsion of engine oil and soap, 2 gal. to 50 gal. of water, with the addition of 2 lbs. of powdered arsenate of lead is said to have been used with good results by the Texas Department of Agriculture.



**The Panama canal species of the genus *Anopheles*, J. ZETEK** (*Med. Assoc. Isthmian Canal Zone Proc.*, 13 (1923), pt. 1-2, pp. 29-56, figs. 6).—The author presents a brief account of the taxonomy of the Panama Canal Zone species of *Anopheles*, nine in number, and of the collection, study, and care of material, together with a list of 21 references to the literature.

**Preferential feeding experiments with anopheline mosquitoes, I. C. G. BULL and F. M. ROOT** (*Amer. Jour. Hyg.*, 3 (1923), No. 5, pp. 514-520, fig. 1).—The author's observations show that the strain of *Anopheles quadrimaculatus* experimented with manifested no decided preference between man, horse, and cow as hosts. The results show that with the horse and cow the individual is of more significance than the species. It is definitely shown that neither the horse nor cow affords absolute protection to man, although man no doubt receives fewer bites because of the presence of these animals.

**Ophthalmia myiasis externa due to larvae of *Oestrus ovis*, H. H. STARK** (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 20, pp. 1684, 1685, figs. 2).—The author records the parasitism of the conjunctiva of the eye of a child of 16 at Las Cruces, N. Mex., by first stage larvae of the sheep botfly.

**Fruit fly menace to America** (*Union So. Africa Dept. Agr. Jour.*, 6 (1923), No. 5, pp. 413-420).—This includes a discussion of The Mediterranean Fruit Fly, by C. P. Lounsbury (pp. 414-420), particularly as relates to the risk of admitting South African fruit into the United States.

**The survival of bacteria in the pupal and adult stages of flies, R. W. GLASER** (*Amer. Jour. Hyg.*, 3 (1923), No. 4, pp. 469-480).—"House fly larvae, on pupating, inclose a considerable number of bacteria within them. These bacteria persist through metamorphosis and 'pass on' to the adult intestine, as was shown in the experiments with recently emerged flies. Bacteria are also found in the upper regions of the air passages of pupae, but what later fate awaits them remains unknown. The adult *Musca domestica* intestine, therefore, whether of recently emerged flies that have not fed or of wild adults of unknown age, is a veritable reservoir for bacteria. Stomoxys larvae on pupating also inclose bacteria within them, but in general a much smaller number per individual than is the case with the house fly. . . . Wild adult Stomoxys of unknown age also harbor bacteria in their intestinal tract, but the number is very small."

**Leperisinus californicus Sw. killing ash trees, R. W. DOANE** (*Canad. Ent.*, 55 (1923), No. 9, p. 217).—The author records the killing of young ash trees at Palo Alto, Calif., by this beetle, the primary injury being done by the adult.

**Use of calcium arsenate on cotton plants** (*U. S. Dept. Agr., Weather, Crops, and Markets*, 4 (1923), No. 20, pp. 506, 507).—This is a brief report of a statistical study of the use of calcium arsenate for the control of the boll weevil in 1923, when practically 10 per cent of the cotton acreage, or 3,772,000 acres, was treated with this poison. About 48 per cent of this acreage was poisoned by dusting the plants, about 40 per cent by daubing of mixtures containing poison, such as molasses and arsenate, and 12 per cent by spraying.

**A root weevil (*Stephanocleonus plumbeus* Lec.) reared from strawberry, S. MARCOVITCH** (*Canad. Ent.*, 55 (1923), No. 9, p. 218).—The author records the discovery that the larva of *S. plumbeus* feeds upon the roots of the strawberry, though it has not been observed to cause any serious injury.

**Deinsecting baled tobacco with ammonia gas** (*Tobacco*, 76 (1923), No. 24, p. 23).—This editorial calls attention to a method of destroying the cigarette beetle by the use of ammonia gas developed by Moens and Ringeling.

**Breeding experiments with confined *Bremus* (*Bombus*) queens, O. E. PLATH** (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 45 (1923), No. 6, pp. 325-341).—The author reports upon experiments with 11 of the 13 New England species,



with 6 of which self-supporting colonies were produced. A list of 19 references to the literature cited is included.

**Morphology and development of *Nosema apis*** Zander, W. TRAPPMANN (*Arch. Bienenk.*, 5 (1923), No. 6, pp. 45-58, figs. 31).—This is a general summary of information on this parasite of the honeybee.

**Studies of ants, IV, V**, A. FOREL (*Le Monde Social des Fourmis du Globe Comparé à Celui de l'Homme*. Geneva: Libr. Kundig, 1923, vols. 4, pp. VI+172, pls. 4, figs. 12; 5, pp. VI+174, pls. 4, figs. 32).—In continuation of the work previously noted (*E. S. R.*, 49, p. 453), volume 4 deals with alliances, war, parabiosis, lestobiosis and kleptobiosis, and slavery; volume 5 with specialized habits, termites and man, etc.

**On the identity of a European chalcidoid parasite of the alfalfa leaf weevil**, A. B. GAHAN (*Jour. Wash. Acad. Sci.*, 13 (1923), No. 18, pp. 408-411).—Under the name *Peridesmia phytonomi* n. sp., the author describes a chalcidoid which the U. S. D. A. Bureau of Entomology is attempting to introduce from France into the Western States to combat the alfalfa weevil. The larva is said to feed externally on the egg masses of *Phytonomus posticus* Gyll.

**British spiders: Their lives, loves, and tragedies**, E. C. ASH (*London: Robert Holden & Co., Ltd.*, pp. 144, figs. 40).—This is a small pocket handbook.

**Possibilities in the transmission of *Onchocerca gibsoni***, R. W. CILENTO (*Jour. Trop. Med. and Hyg.* [London], 26 (1923), No. 16, pp. 271, 272).—The author reports upon the progress of attempts to transmit *O. gibsoni*.

## FOODS—HUMAN NUTRITION.

**The physiology of insulin**, H. H. DALE (*Lancet* [London], 1923, I, No. 20, pp. 989-993).—This lecture consists of a concise historical review of experimental evidence on the function of the pancreas, leading up to the discovery of its active principle, insulin. This is followed by a discussion of the possible chemical nature of insulin and its distribution in nature, function, and possible mode of action.

**Insulin in tissues other than the pancreas.—Preliminary communication**, C. H. BEST and D. A. SCOTT (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 5, pp. 382, 383).—The authors report that they have been able to prepare active extracts of insulin from the submaxillary, thymus, and thyroid glands and from liver, spleen, and muscle tissue. A substance believed to be insulin has also been found in the blood of various animals and in human urine. This substance is thought to be excreted in larger amounts by pregnant women than by normal men.

**The effect of insulin on the glycogen in the tissues of normal animals**, H. W. DUDLEY and G. F. MARRIAN (*Biochem. Jour.*, 17 (1923), No. 3, pp. 435-438).—From determinations of the glycogen content of the livers of normal and insulin-treated mice and of the liver and muscles of normal and insulin-treated rabbits, the conclusion is drawn that the sugar which disappears from the blood of normal animals following the injection of insulin is not converted into glycogen nor stored as such in the liver or in the skeletal muscles. Similarly no evidence of a conversion of carbohydrate into fat in normal animals under the influence of insulin could be obtained.

**The effect of ultraviolet light on the condition of calcium in the blood**, J. H. CLARK (*Amer. Jour. Hyg.*, 3 (1923), No. 4, pp. 481, 482).—This is a brief report of a study of the effect of ultraviolet light on the amount of dialyzable or ionized calcium in blood serum.

Fresh serum from dogs or rabbits was radiated in quartz test tubes with a quartz mercury arc and then compared with unirradiated serum from the same



animals, the two samples being dialyzed under identical conditions. After dialyzing for two hours the calcium in the dialyzate was precipitated as oxalate, filtered through hardened filter paper, dissolved in sulphuric acid, and titrated against potassium permanganate. The serum inside the sac was then taken, the proteins precipitated with trichloroacetic acid, and the calcium in the filtrate determined in the same way.

The average results obtained with rabbit's blood were 38 per cent dialyzed from unirradiated serum and 58 per cent from radiated, and for dog's blood 44 and 53 per cent, respectively. In the dog the percentage of diffusible calcium in unirradiated serum was very constant, while in the rabbit it varied from 25 to 50 per cent. This variation was thought to depend somewhat on the diet, as when the animals were fed for several days on a diet containing cod liver oil there was an increase in the dialyzable calcium.

It is concluded that the curative action of ultraviolet light in the low-calcium form of rickets may be due to an increase in the diffusible calcium of the blood plasma or tissue lymph.

**The influence of the mother's diet during pregnancy and lactation upon the growth, general nourishment, and skeleton of young rats,** V. KORENCHIEVSKY and M. CARR (*Jour. Path. and Bact.*, 26 (1923), No. 3, pp. 389-398, figs. 2).—This paper supplements previous work (E. S. R., 50, p. 63) on the influence of the diet of the mother during pregnancy and lactation on the nutrition of the offspring, particularly with regard to the development of rickets. In the experimental work reported, the young of rats which had been on diets rich and poor in the fat-soluble vitamin and calcium during pregnancy or lactation or both were removed from their mothers at the age of 24 days. Some of each litter were killed and examined and the others fed on a diet deficient in vitamin A for a further period of 40 days and then killed and examined.

It was found that the mother's diet during pregnancy and lactation had an important effect on the nutritive condition of the young subsequent to their being placed on the deficient diet. The group of young rats whose mothers had received large amounts of cod liver oil during the lactation period differed but little from normal controls even after a considerable period on the deficient diet, particularly if the mothers had received liberal amounts of calcium during the early period of lactation. The condition of the young of rats which had been maintained during lactation on a diet deficient in fat-soluble vitamin depended upon the diet of the mother during pregnancy. If the diet during that period was rich in fat-soluble vitamin the young were much better able to withstand the effects of the deficient diet than were the offspring of rats which had received a deficient diet during pregnancy. This was also true of the calcium, the most pronounced effect being produced by a large amount of calcium in the mother's diet, not during lactation, but during pregnancy.

These findings are considered to point to the importance of an abundance of fat-soluble vitamin and calcium in the diet of nursing women and of a sufficiency of both factors during pregnancy.

**Existence of a hitherto unknown dietary factor essential for reproduction,** H. M. EVANS and K. S. BISHOP (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 11, pp. 889-892).—This is a more detailed report concerning the occurrence and nature of the dietary factor essential for reproduction (E. S. R., 48, p. 864).

Of fresh green lettuce leaves, 40 gm., equivalent to less than 1.5 gm. dry weight, have proved ample and 10 gm. probably sufficient to restore fertility in rats. The seedlings of Canadian field peas were found to have about the same value. Of other materials, the amounts found sufficient to restore to normal fertility rats in which sterility disease had been proved to exist are



wheat embryo 0.25 gm. daily, egg yolk (one-third of the fresh total yolk), and the cooked meat of the jaw and cheek musculature of the cow 1 gm. As a prophylactic administered over a long time, the same materials proved even more efficacious, thus indicating a storage of the vitamin.

**Food selection v. food compounding**, A. E. TAYLOR (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 11, pp. 892-894).—In this discussion of the economics of food selection, the author considers the diet as consisting of two parts, the maintenance ration containing salts, vitamins, and balanced protein, and the work ration consisting of starch, fat, and protein. In educating the public to a wise and economical selection of foods, the maintenance ration in his opinion must be held inviolable, and such economy as must be practiced should be in the line of cheapening the work ration. The advantages and disadvantages are discussed of the use of a single compounded food such as vitamin bread, which in itself is sufficient for maximum nutrition. While conceding the value of such a food in districts where agriculture is not sufficiently diversified and among people who through ignorance do not make the proper selection of food, it is pointed out that the attempt to administer a large proportion of the diet in the form of a single food runs counter to natural tastes.

**Food allergy as a cause of illness**, W. W. DUKE (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 11, pp. 886-889).—This is a general discussion of the nature of food allergy or hypersensitiveness to foods, contributory causes of symptoms, types of reaction, symptoms, diagnosis, and treatment.

**Studies in anemia, I, II**, J. M. D. SCOTT (*Biochem. Jour.*, 17 (1923), No. 2, pp. 157-169, fig. 1).—Two papers are presented.

I. *The influence of diet on the occurrence of secondary anemia following repeated hemorrhages in rats*.—In the main experimental work reported in this paper, rats were fed from a few days after weaning to shortly after puberty, 90 days, on a diet of bread and milk, with control animals on a diet of bread, milk, and green stuff. Both groups were then subjected at weekly intervals to 8 bleedings, each of about 1 per cent of the body weight. As a further control some of the animals were kept on the basal diet alone and not subjected to bleeding. The condition of the blood after this procedure was determined from the color index obtained by dividing the percentage of hemoglobin by twice the number of red blood corpuscles.

The rats on the bread and milk showed after these bleedings a fall in the color index persisting for two or three weeks after the bleeding was stopped, while the controls showed a comparatively inappreciable fall in the color index.

In the second paper the author reports that young rats, bred from mothers which had been kept on a diet of white bread and whole milk from puberty until 10 months old, showed chronic anemia characterized by marked lowering of the color index. This tended to improve gradually when the animals were kept on a diet of white bread and milk and rapidly on this diet plus green stuff.

**A proof of the regulatory influence of cod liver oil on calcium and phosphorus metabolism**, E. A. PARK, R. A. GUY, and G. F. POWERS (*Amer. Jour. Diseases Children*, 26 (1923), No. 2, pp. 103-111, fig. 1).—To study the influence of cod liver oil in regulating calcium and phosphorus metabolism, 5 groups of 16 rats each were fed for a period of 35 days on rations differing only in the proportion of calcium and phosphorus. At the end of this time one-half of the animals were bled, and determinations made of the calcium and inorganic phosphorus of the pooled blood serum. The remaining animals were continued for 10 days longer on the same diet with the addition daily of 2 per cent of cod liver oil, and were then bled for similar determinations of calcium and phosphorus. The animals were in all cases examined for rickets.



The proportions of calcium and inorganic phosphorus in the diet were reflected in the analysis of the blood at the end of the first 35-day period, a deficiency in either one resulting in lower values of that element in the blood serum. In the case of the diet furnishing a great excess of inorganic phosphorus the blood serum contained an unusually large amount of phosphorus, thus showing that the level of phosphorus can be raised above values considered normal.

The effect of the cod liver oil was consistently to correct the proportion of calcium and phosphorus, raising whichever one was low to the normal value. Rickets in varying degrees was noted in the animals on diets deficient in both calcium and phosphorus, in calcium alone, and in phosphorus alone.

In discussing these results the authors advance the opinion that cod liver oil acts upon the body as a whole by supplying it with something which is essential for optimal cellular function, and that "the power to raise the calcium in the blood when the calcium is low, or the phosphorus when that is low, is merely an isolated example of an effect which happens to be visible and measurable. Doubtless, cod liver oil and radiant energy will be found to have similar regulatory and efficiency producing effects in all conditions in which the organism is suffering as a result of a deficiency in the factor contained in cod liver oil or in radiant energy."

**The history of cod liver oil as a remedy**, R. A. GUY (*Amer. Jour. Diseases Children*, 26 (1923), No. 2, pp. 112-116).—This is a brief historical survey of the various therapeutic uses to which cod liver oil has been put from 1798 to the present time.

**Pathologic effects of lack of vitamin A and of antirachitic vitamin**, E. V. McCOLLUM (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 11, pp. 894-899).—This is a review of investigations which have been noted from their original sources.

**The presence of antiophthalmic vitamin and the absence of antirachitic vitamin in dried spinach**, J. F. McCLENDON and C. SHUCK (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 5, p. 288).—Dried spinach in amounts up to 75 per cent of the diet is reported to have no antirachitic effect for rats, while as small an amount as 0.1 per cent is said to have a pronounced effect in retarding ophthalmia, and 0.5 gm. daily to be sufficient to cure advanced cases of ophthalmia.

**Nasal sinusitis produced by diets deficient in fat-soluble A vitamin**, A. L. DANIELS, M. E. ARMSTRONG, and M. K. HUTTON (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 10, pp. 828, 829).—The observation that the paranasal sinuses and mastoid cells of rats which had died as the result of a deficiency of vitamin A invariably contained purulent material led to a more detailed examination of the heads of 16 young rats which had been for varying lengths of time on diets low in vitamin A and of 29 adult rats which had been fed on a complete ration or on rations deficient only in vitamin B and in calcium, respectively.

Of the animals on the vitamin A-deficient diet, 1 which was killed after being on this diet only 4 weeks showed no signs of nasal infection, while all of the others showed in marked degree purulent infection of the nasal mucosa and in most cases pus in the middle ear and abscesses at the base of the tongue. Of the animals serving as controls, 5 showed a slight reddening of the nasal mucosa, but with no pus, no signs of middle ear infection, and no abscesses at the base of the tongue.

The authors conclude "that the fat-soluble vitamin A plays an important rôle in the immunity of the organism to pyogenic infections, and the general breakdown of the organism following the ingestion of diets low in the fat-soluble vitamin is secondary to such infection."



**Study of artificial nutrition in the pigeon and of the deficiency in vitamins,** J. HOET (*Biochem. Jour.*, 17 (1923), No. 2, pp. 220-229, pl. 1, figs. 2).—The author has adopted the following ration for vitamin B studies with pigeons: Commercial casein 18, rice starch 60, McCollum's salt mixture 4, filter paper 3, margarin 10, and butter fat 5 parts. This ration, supplemented by an extract of yeast equivalent to 1 gm. daily of the dried yeast, is said to provide all the requirements for satisfactory growth and reproduction in pigeons and to prevent or cure experimental polyneuritis. The minimum dose of the yeast for pigeons weighing from 350 to 400 gm. is between 0.8 and 0.9 gm., while a dose of 0.6 gm. is sufficient to relieve polyneuritic symptoms and bring about a slow gain in weight in pigeons weighing from 250 to 300 gm.

The yeast is administered every 3 or 4 days, apart from the basal ration and in the form of a concentrated aqueous extract prepared as follows: Two hundred gm. of the dried brewery yeast is added to 2 liters of water and the whole brought to the boiling temperature and boiled rapidly for 5 minutes, after which it is filtered and evaporated on a water bath to from one-fifth to one-tenth of its original volume. The extract is administered in this form, or concentrated still further by the addition of an equal volume of 95 per cent alcohol and distillation of the filtrate under reduced pressure.

The ration described above, modified to the extent of substituting 15 gm. of hydrogenated peanut oil for the margarin and butter, has been used to determine whether pigeons require vitamin A. Six pigeons were kept on this ration for more than six months, during which time there was no evidence of nutritional failure and eggs were laid and hatched. It is concluded that, for adult pigeons at least, vitamin A is not necessary.

**A study of the relation of the quantity of fat-soluble organic factor in the diet to the degree of calcification of the bones and the development of experimental rickets in rats,** H. GOLDBLATT (*Biochem. Jour.*, 17 (1923), No. 2, pp. 298-326, pls. 2, figs. 5).—In the first part of this investigation a study was made of the effect of the quantity of the fat-soluble vitamin in the diet of growing rats on the degree of calcification of the bones and the development of rickets. The synthetic diet adopted consisted of commercial casein 20, wheat starch 50, fat 15, McCollum's salt mixture 5, and marmite 5 gm., with orange juice 5 cc. and distilled water 50 cc. For the normal control diet the fat used was butter and for the experimental diets hardened cottonseed oil. To provide for a gradation in the amount of fat-soluble vitamin, the experimental diets were further altered by substituting for varying amounts of the commercial casein its equivalent in casein freed from vitamin A by the oxidation method of Hopkins. The amounts of calcium and inorganic phosphorus in the diets were 0.4 and 0.8 gm., respectively, per 100 gm. of the diet. Twelve series of rats each consisting of 6 animals from the same litter were used, a representative of each series being placed on each of the 6 experimental diets. Six series were killed after 7 weeks and the remainder at intervals up to 14 weeks, all being subjected to gross, microscopical, and chemical analysis.

The gradation of fat-soluble vitamin in the diet was found to result in a corresponding gradation of calcium in the bones, and the animals on the diets deficient in the fat-soluble vitamin showed slight to severe osteomalacia or rickets.

To determine whether the rather low amount of calcium in the diet had any effect upon the resulting condition, a second series of experiments was conducted, using the most deficient of the diets employed in the first series, but with the addition in one case of two and in the other of four times the original quantity of calcium. This resulted in a slight average increase of calcium de-



posited, but did not prevent the development of pathological changes in the bones.

A third series of studies was then undertaken, using as experimental animals young rats which had been bred from stock which had been kept for some time on diets containing considerable cod liver oil. This increase in the amount of fat-soluble vitamin was reflected in a much more rapid growth of the young during lactation and a higher average percentage of calcium in the bones as compared with the animals in the other series and less difference as between the different diets in the series. One or two of the animals, however, showed slight signs of rickets. As a final study, animals bred from the stock which had received an abundance of fat-soluble vitamin were fed the same diets, with increased amounts of calcium, as in the second series of studies. An increase in the calcium content of the diet did not increase the percentage of calcium deposited in the bones, but a decrease in the calcium content by about 25 per cent resulted in a corresponding slight decrease in the percentages of calcium deposited in the bones.

The author concludes that "in the absence of exposure of the animals to direct sunlight or artificial substitutes for it, the fat-soluble organic factor in the diet, by itself, plays an important rôle in the mechanism for the deposition of calcium in the bones of rats. The reduction below a certain level of the quantity of fat-soluble organic factor in an otherwise complete diet results in a diminished calcium deposit in the bones."

A study of rats on a normal diet irradiated daily by the mercury vapor quartz lamp or kept in darkness, H. GOLDBLATT and K. M. SOAMES (*Biochem. Jour.*, 17 (1923), No. 2, pp. 294-297, pl. 1).—In this study two litters of rats were placed at weaning on normal diets containing optimal amounts of calcium, phosphorus, and fat-soluble vitamin, the latter in the form of cod liver oil or butter. One-half of the animals in each litter was kept in the dark and the other in daylight, the latter also receiving a daily irradiation for 20 minutes under a mercury vapor quartz lamp. At the end of eight weeks the animals were killed and subjected to gross and histological examination, with chemical analysis of the bones of the hind legs for calcium and water. No appreciable difference was found between the growth of the two groups, or in the histology and calcium content of the bones. It is concluded that, if the diet is satisfactory, light in itself is not essential for the prevention of rickets.

The effect of air, which has been exposed to the radiations of the mercury vapor quartz lamp, in promoting the growth of rats fed on a diet deficient in fat-soluble vitamins, E. M. HUME and H. H. SMITH (*Biochem. Jour.*, 17 (1923), No. 2, pp. 364-372, figs. 4).—Evidence is furnished in this report that air previously irradiated by exposure to ultra-violet light is capable of producing, though to a somewhat less marked extent than direct irradiation itself, growth response in rats on diets deficient in fat-soluble vitamin. It is also shown that the effect is due to the irradiated air and not to some property of the glass container in which the air had been irradiated, and that ozone is not responsible for the effect. The possibility is suggested that the favorable effect may have been due to ionization of the air.

Glands of internal secretion in experimental avian beriberi, V. KOREN-CHEVSKY (*Jour. Path. and Bact.*, 26 (1923), No. 3, pp. 382-388, pls. 2).—A brief report is given of an examination of the glands of internal secretion of seven groups of pigeons, all of which received a basal diet of polished rice and water, with supplements in various groups of cod liver oil, autolyzed yeast, and lemon juice alone or in combination. Five of the groups received no vitamin B, and all of these developed polyneuritis. The sixth and seventh groups



received, respectively, autolyzed yeast and autolyzed yeast, cod liver oil and lemon juice, and none developed polyneuritis. So far as possible, the pigeons were killed in the most active stage of the disease, controls were killed at the same time, and the examination of the glands made as rapidly as possible.

The most characteristic changes noted in the pigeons suffering from polyneuritis were "hypertrophy of the suprarenals, atrophy of the thymus, and atrophy of the spleen with persistence of the islets of the germ centers, often accompanied by an increase in their number and size and frequent hypertrophy and hyperplasia of the islet cells." Changes noted in some but not all of the polyneuritic pigeons are summarized as follows: "The frequent presence of the stage of the greatest activity in the thyroid gland on beriberi-producing diets deficient in fat-soluble factor (principally on a diet of rice, or rice and olive oil), tendency to hypertrophy and hyperplasia of the inner secretory interstitial cells of the testicles, and increased number and hypertrophy of the large light cells of the pituitary body."

### ANIMAL PRODUCTION.

**Problems in the field of animal nutrition**, E. B. FORBES ET AL. (*Science*, 57 (1923), No. 1481, pp. 567-571).—The subcommittee on animal nutrition of the National Research Council has discussed the more important problems which must be solved to make for the most rapid advancement in the field of animal nutrition. The following fields are recommended as worthy of extensive and thorough research: (1) A general program of research on foods of animal origin in relation to human nutrition and to agriculture, (2) growth curves of farm animals, (3) the establishment of a scientific basis for judging farm animals, (4) the estimation of metabolic nitrogen as a contribution to the perfection of feeding standards, (5) mineral requirements of farm animals, (6) vitamin requirements of farm animals, and (7) diet and reproduction.

[**First report of the Rowett Institute, 1922**] (*Rowett Inst., Bucksburn, Aberdeen, Rpt., 1* (1922), pp. 94, figs. 13).—This is the first report of the joint committee on research in animal nutrition from the Rowett Institute. It deals with the history of the establishment of the institute, a description of the equipment, and a brief account of the research work, practically all of which has been reported and noted from individual papers.

The work has included studies of the mineral requirements of pigs and sheep; vitamin requirements of pigs, lambs, guinea pigs, and chickens; rickets in pigs; physiology of lactation in goats; variation in the composition of cow's and goat's milk; indirect calorimetry with goats; quality and quantity of proteins in feeding chickens, pigs, and man; feeding tests with fish meal, milk, and distillery residues for pigs; analysis of human and animal foods; effect of ventilation and light on the growth of pigs; and the influence of nutrition on scrapie, vinquish, and louping-ill in sheep.

**Animal nutrition, foods and feeding**, E. T. HALNAN (*London: Benn Bros., Ltd., 1923*, pp. 52, figs. 8).—The principles of animal nutrition are very briefly discussed with reference to their practical application.

**The chemistry of foods**, F. W. HARDY (*Natl. Poultry Jour., 3* (1923), Nos. 143, p. 544; 144, p. 558; 145, pp. 572, 573; 146, pp. 590, 591; 147, pp. 608, 609; 150, pp. 654, 655; 151, pp. 675, 676; 152, pp. 702, 703; 153, pp. 708, 709; 154, p. 723; 4 (1923), No. 157, pp. 2, 3).—A discussion of the chemical elements commonly found in feeding stuffs and the use and digestibility of the organic constituents is given. The general principles of animal feeding are also outlined.



**The importance of fat in animal feeding: The adipo-protein ratio,** E. LETARD (*Rev. Zootech. [Paris]*, 2 (1923), No. 4, pp. 292-303, fig. 1).—The importance of the fat in rations of farm animals is emphasized, and the ratio between the fat and protein, called the adipo-protein ratio, is discussed for the different classes of animals of varying ages. The adipo-protein ratio of different milks is given, and this is taken as a standard for the rations of young animals.

A calf fed on whole milk and cream made better and more economical growth as determined by the organic substance consumed per kilogram of growth than other calves fed on skim milk or skim milk and whole milk.

The author believes that the fat tends to aid in the economical utilization of the other constituents of the ration and the destruction of toxic proteins, aside from its actual food value.

**The nutritive value of the proteins of coconut meal, soy beans, rice bran, and corn,** H. H. MITCHELL and V. VILLEGAS (*Jour. Dairy Sci.*, 6 (1923), No. 3, pp. 222-236).—The results of experiments carried on at the Illinois Experiment Station to study the proteins of coconut meal, soy beans, rice bran, and corn, are reported in detail. The nutritive value of the digestible proteins were measured by K. Thomas's method for determining the "biological value" of the protein, which refers to the number of parts of body protein that may be spared by 100 parts of digestible food protein.

Nine rats were used as experimental animals for eight feeding periods. During the first and eighth periods nitrogen-free diets were fed, and the endogenous nitrogen excretions in the urine and feces were thus determined. In the second and third periods the rats were divided into groups of three each and fed rations containing 5 per cent of protein supplied by coconut meal, soy beans, or corn, and the average biological values of the respective proteins determined as 77, 78, and 72 per cent. In other periods the rations contained 10 per cent protein from coconut meal, soy beans, or rice bran, and the average biological values of the respective proteins were 58, 64, and 67 per cent. Rations containing 10 per cent protein supplied by combinations of feeds as follows were also fed: Soy beans 11.9 and corn 60.5 per cent, coconut meal 24 and corn 57.8 per cent, and coconut meal 24 and rice bran 42.8 per cent. The balance of all rations were made up by starch, agar, sucrose, butter fat, and salts. The average biological values of the proteins from the combinations were corn and soy beans 66 per cent, coconut meal and corn 58, and rice bran and coconut meal 63 per cent.

The net protein values of the feeds were calculated by multiplying the content of digestible protein in the feed (from Henry and Morrison's tables) by the biological value of the protein. Brief reports of these results have been previously noted (*E. S. R.*, 49, p. 369), but no detailed account of the method of calculating biological values was given.

**The use of cod liver oil in the feeding of farm animals,** J. C. DRUMMOND, S. S. ZILVA, and J. GOLDING (*Jour. Agr. Sci. [England]*, 13 (1923), No. 2, pp. 153-162).—This is essentially a discussion of the method of manufacture, composition, food value, and different grades of cod liver oil. Its use as a regular feed is recommended for pigs in amounts of 0.25 to 1 oz. per day, for pregnant sows in amounts of 1.5 to 2 oz. daily, and for cows in amounts of 2 oz. per day. Warnings against oils of poor quality and proprietary feeds containing low grades of cod liver oil are given. A bibliography of 22 references is appended.

**Sunflower silage,** A. AMOS and H. E. WOODMAN (*Jour. Agr. Sci. [England]*, 13 (1923), No. 2, pp. 163-168).—The composition of sunflower silage made from the Giant Ensilage variety of sunflowers was studied at Cambridge University and compared with the composition of the green sunflowers as they were put in the silo October 11, 1921. When the silo was opened on January 12, 1922, the



silage was of good quality and of a dark brown color, possessing a strong but pleasant odor. The thick parts of the stem had an outer woody coat of an indigestible appearance. A maximum thermometer placed in the silo at filling time 6 in. below where the good silage began registered 23° C. (73.4° F.)

As compared with the green sunflowers, the silage showed the following percentage of changes: Total moist material -6.9, dry matter -4.8, organic matter -5.8, crude protein +0.1, ether extract +111.2, nitrogen-free extract -16.6, crude fiber +2.3, ash +2.1, true protein -14.5, amids +38.7 and pepsin-hydrochloric acid soluble protein -5.5 per cent. The protein was not so digestible as in the oat and tares noted (E. S. R., 48, p. 167), either in the green plant or in the silage.

In testing the palatability of the silage, 2-year-old steers were a bit reluctant to taste it but 22 animals finally ate 500 lbs in 3 days.

**The nature of the pigment of silage**, H. E. WOODMAN (*Jour. Agr. Sci. [England]*, 13 (1923), No. 2, pp. 240-242).—Tests of samples of oat and tare silage and corn silage at Cambridge University have indicated that the brown color of silage is due to phaeophytin, which differs from chlorophyll only by lacking the one atom of magnesium which is present in the chlorophyll molecule. This change from chlorophyll may be brought about by the action of carbon dioxide.

**Commercial feeding stuffs, 1922-23**, J. M. BARTLETT (*Maine Sta. Off. Insp.* 108 (1923), pp. 9-28).—This is the usual report of the official inspection of feeding stuffs (E. S. R., 48, p. 68), containing the definitions of feeding stuffs and the analysis of the samples officially inspected during the year preceding July 1, 1923.

**When should the farmer sell home-grown foods?** A. G. RUSTIN and J. S. SIMPSON (*Jour. Min. Agr. [Gt. Brit.]*, 29 (1922), No. 9, pp. 783-788, figs. 4).—Diagrams are presented showing the cost of a unit of starch equivalent in the different home-grown and purchased feeds when the feed is available at different prices per ton. By the use of these diagrams the authors deem it a simple matter to determine whether more starch equivalent could be obtained by selling home-grown feeds and purchasing others or by feeding the home-grown feeds.

**Proceedings of the twenty-sixth annual convention of the American National Livestock Association** (*Amer. Natl. Livestock Assoc. Proc.*, 26 (1923), pp. 152, pls. 7).—This consists of the usual report (E. S. R., 48, p. 266) of the annual meeting of this association held at Los Angeles, Calif., January 30 and 31 and February 1, 1923. Many papers and discussions of primary interest to the practical stockman are included.

**Determination of the surface area of cattle and swine**, A. G. HOGAN and C. I. SKOUBY (*Jour. Agr. Research [U. S.]*, 25 (1923), No. 10, pp. 419-430, pl. 1).—The authors have derived a formula for determining the surface area of cattle and hogs, based upon the height-weight formula of DuBois (E. S. R., 34, p. 68),

$$S=W^{\cdot 4} \times L^{\cdot 6} \times K$$

S is the surface area in square centimeters, W is the weight in kilograms, L is the length in centimeters from the withers to the root of the tail in swine and to the point of the ischium in cattle, and K is a constant, which was determined as 217 for cattle and 175 for swine.

The surface areas have been calculated for 37 cattle ranging in age from 6 weeks to 8 years and in weight from 55 to 842 kg., and it was shown that the maximum errors between the calculated area and the surface area, as measured by a paper mold, were less than 5.5 per cent. The maximum errors for the surface as calculated for the swine were also less than 5.5 per cent in the



case of the 24 animals of the different breeds which were measured. The results are compared with the formulas of Moulton, as reported in Missouri Station Research Bulletin 18 (E. S. R., 33, p. 659), and by the formula of Meeh, and it is shown that the formula suggested by the authors agrees more closely with the actual measurements than any of the other available methods.

**The identification of animals by nose prints**, P. DECHAMERE (*Rev. Zootech.*, [Paris], 2 (1923), No. 4, pp. 286-291, figs. 2).—In the author's investigations he has been able to identify successfully dogs and cattle by nose prints, as was previously done by Petersen (E. S. R., 47, p. 783).

**Steer feeding experiment [at the Lethbridge Experimental Station]**, W. H. FAIRFIELD (*Canada Expt. Farms, Lethbridge (Alta.) Sta. Rpt. Supt. 1922*, pp. 9-11).—Three lots of 13 1,000-lb. steers each were selected for comparing different roughages for fattening steers in a 118-day test. Each lot received the same quantity of a grain mixture composed of ground oats and barley, but the roughages varied as follows: Lot 1 alfalfa hay and sunflower silage, lot 2 alfalfa hay and corn silage, and lot 3 alfalfa hay. The average daily gains and costs per pound of gain were, respectively, as follows: Lot 1 1.46 lbs. and 14.1 cts., lot 2 1.66 lbs. and 12.5 cts., and lot 3 1.31 lbs. and 14.7 cts.

There was a calculated financial loss of from \$12.72 to \$13.80 per steer from the feeding, due to the poor price received for the fattened animals. The sunflower silage was not eaten at first as well as the corn silage, but the maximum consumption was 25 lbs. per head, the one lot being limited to the consumption of the other.

**Steer feeding [at the Morden Experimental Station]**, W. R. LESLIE (*Canada Expt. Farms, Morden (Man.) Sta. Rpt. Supt. 1922*, p. 11).—In a test to determine the profits which may result from steer feeding, 8 steers averaging 1,075 lbs. in weight were fed from November 27, 1921, to April 11, 1922 (135 days), on corn silage, oat straw, and cull potatoes. On January 16 a grain ration of oat and barley chop was added. Average daily gains per steer of 2 lbs. were made at an estimated cost of 10.17 cts. per pound. The steers were sold at a profit of \$4.87 each.

**[Steer feeding experiments at the Lennoxville Experimental Station]**, J. A. McCLARY (*Canada Expt. Farms, Lennoxville (Que.) Sta. Rpt. Supt. 1922*, pp. 6-9, figs. 2).—To compare heavy and light stockers for winter fattening, 10 steers averaging 719 lbs. were compared with 10 steers averaging 886 lbs. on daily rations of 10 lbs. of hay, 30 lbs. of silage, and 3.96 lbs. of meal. The light steers cost 4.5 cts. per pound as compared with 5.5 cts. for the heavy steers, but the latter lot made a greater profit per steer, due largely to the fact that they made average daily gains of 1.48 lbs., as compared with gains of 1.37 lbs. by the lighter lot.

Two years' results are reported in feeding 3 lots of 6 steers each on 40 lbs. of silage per day, with hay ad libitum, until November 15, January 15, and March 1, respectively, for the different lots, when grain (elevator screenings, oats, and bran 2:1:1) was substituted for part of the silage. Grain was thus fed 169, 109, and 61 days in the 3 lots, and the average daily gains were, respectively, 1.53, 1.27, and 1.13 lbs. The profits per steer were calculated at \$4.25, \$4.26, and \$8.34.

Steers allowed to run loose in box stalls made slightly greater and cheaper gains than steers tied, in experiments during the winters of 1919, 1920, 1921, and 1922.

One lot of 8 steers fattened on a grain ration consisting of equal parts of bran, corn, ground oats, and barley made average daily gains of 1.44 lbs. at a calculated cost of 12.85 cts. per pound, as compared with gains of 1.28



lbs. per day at a feed cost of 12.45 cts. per pound by steers receiving a ration of 2 parts of ground screenings and 1 part of bran. The author recommends screenings as a valuable feed when the price is reasonable.

[**Cattle feeding experiments in Rhodesia**], E. A. NOBBS (*Rhodesia Agr. Jour.*, 20 (1923), No. 1, pp. 39-46).—Two cattle feeding experiments are reported.

*Cattle fattening experiment No. 11, Government experiment farm, Gwebi.*—One lot of 3-year-old grade Shorthorn steers were fattened at the Gwebi Experimental Farm for 112 days on rations consisting mainly of home-grown feeds. The steers used had just previously been brought from the mountains at the end of the grass season. During the feeding period they made average daily gains of 2 lbs. per day.

Another lot brought from the mountains at the same time were allowed to graze on old lands until the first lot had been marketed, after which they were finished on similar feeds in a 96-day period. Their average gains were 2.07 lbs. per day. This demonstrated that two lots of cattle may be finished during the year where equipment for fattening only one lot is available.

*Cattle fattening experiment No. 12.*—A lot of grade Sussex steers, similar to the Shorthorns fed in the first test above, were fed at the same time and compared with them. The rates of gain were practically the same in both cases.

**A comparison of types of lambs and systems of production**, J. W. HAMMOND (*Ohio Sta. Bul.* 367 (1923), pp. 185-239, figs. 9).—This bulletin reports the results of 6 years' tests at the Southeastern Test Farm of the comparative profits to be expected from purebred Merino lambs and crossbred lambs from Merino ewes×Southdown or Shropshire rams when the lambs are marketed in their first spring and when they are held over until after shearing in the succeeding spring. The crossbred lambs produced during the first 3 years, the spring of 1914, 1915, and 1916, were all sired by a Southdown ram. The purebreds and crossbreds that were sold in the spring of their birth were mostly born in January and February, whereas those carried over until the following spring were born a little later.

The results of the tests, which are tabulated in detail, indicate that for the spring lambs the net cost of feed (cost of feed after deducting value of gain produced by ewes and value of wool) was decidedly greater for the Merinos than for the crossbreds, but the reverse was true for the lambs sold just under 1 year of age. This is due to the more rapid growth of the crossbreds at first and the heavier fleeces of the Merinos at 1 year of age. The selling price, finish, and dressing percentages of the crossbreds were somewhat better than for the Merinos.

The policy of selling the lambs as feeders in the fall as compared with winter feeding depends largely on the amount and cost of feeds available. Lots of Merino, Southdown×Merino, and Shropshire×Merino lambs born mostly in February of 1917, 1918, 1919, and 1920 were marketed after shearing at nearly 1 year of age. Lots of Southdown×Merino and Shropshire×Merino lambs were marketed in the fall of 1918 and 1920 for comparison. The results indicated no great difference in the net feed costs of the two kinds of crossbreds for the production of fall feeders, but when the lambs were sold at nearly 1 year of age the net feed costs per 100 lbs. were lower for the crossbreds sired by the Shropshire ram than for those sired by the Southdown ram. It was, however, lowest in the case of the Merino lambs, due again to their heavy fleeces. The Southdown×Merino lambs always brought the best price at the market, the Shropshire crosses and pure Merinos being more rangy.



The results of these tests indicate that where spring lambs are produced from Merino ewes it will be more profitable to cross them with a Southdown ram. This also probably applies to the production of fall feeder lambs, but in the case of lambs that are held over to the following spring the purebred Merinos were more profitable, and this also does away with the difficulty of maintaining the flock of ewes which is encountered with crossbreeding.

**Soy bean hay for fattening lambs**, W. G. KAMMLADE (*Breeder's Gaz.*, 84 (1923), No. 6, p. 148).—Soy bean hay and alfalfa hay were compared at the Illinois Experiment Station for fattening lambs in a 96-day trial. Each lot received shelled corn in addition. The lot receiving alfalfa hay consumed an average daily ration of 1.09 lbs. of shelled corn and 1.45 lbs. of alfalfa hay and made an average daily gain of 0.34 lb. The lot receiving soy bean hay consumed an average daily ration of 1.12 lbs. of shelled corn and 1.75 lbs. of soy bean hay, making average gains of 0.33 lb. per day. The author states that about one-fifth more soy bean than alfalfa hay must be fed to obtain equal results.

**Winter lamb feeding, 1919-20, 1920-21, 1921-22**, W. H. SAVIN (*Nebraska Sta. Bul.* 197 (1923), pp. 23, fig. 1).—This is a composite report of the 3 years' lamb feeding experiments in comparing various supplements to a basal ration of corn and alfalfa hay (*E. S. R.*, 47, p. 775; 49, p. 774). The average of the 3 years' experiments showed that the lambs receiving the basal ration made average daily gains of 0.340 lb. The average daily gains with different supplements included in the ration were corn silage 0.324, molasses meal 0.361, molasses meal and corn silage 0.337, linseed oil meal 0.387, and linseed oil meal and corn silage 0.364 lb. The calculated profits per head varied from \$2.87 for the lot receiving molasses meal and corn silage to \$3.77 when linseed oil meal was the supplement. The lot on the basal ration made an estimated profit of \$3.72 per head.

**Lamb feeding experiment [at the Lethbridge Experimental Station]**, W. H. FAIRFIELD (*Canada Expt. Farms, Lethbridge (Alta.) Sta. Rpt. Supt.* 1922, pp. 11-13).—Three lots of 40 range lambs each were selected for comparing different roughages in a 96-day test. Lot 1 received alfalfa hay and sunflower silage, lot 2 alfalfa hay and corn silage, and lot 3 alfalfa hay. The lambs received 0.5 lb. of whole oats per day at the start of the test which was increased to 1 lb. per head per day at the end of the test. The sunflower was less palatable than the corn silage, but the amount of corn silage fed was regulated by the amount of sunflower silage consumed, so that lots 1 and 2 each had an equal amount of silage. The lambs, averaging 67 lbs. at the start of the test, made average daily gains in lot 1 of 0.23, lot 2 0.22, and lot 3 0.2 lb. The estimated costs per pound of gain in the different lots were, respectively, 8.3, 8.8, and 9.4 cts.

**Cost of raising lambs to market age**, J. A. MCCLARY (*Canada Expt. Farms, Lennoxville (Que.) Sta. Rpt. Supt.* 1922, pp. 13, 14).—Based on the results of the feed required for 52 ewes and 1 ram for a year, the interest on the investment and depreciation on the buildings and other costs, it was found to cost \$4.37 to raise a lamb to marketing age at an average weight of 110.5 lbs. There were 55 lambs saved from the 52 ewes. The values of the fleeces were deducted in calculating the cost.

**Lamb raising for profit**, F. B. HINTON (*Agr. Gaz. N. S. Wales*, 34 (1923), No. 4, pp. 242-248, figs. 2).—The results of lamb raising trials at Cowra and Bathurst Experiment Farms in comparing Dorset Horn, Southdown, and Ryeland rams are reported. At the Cowra farm 2 rams of each breed were mated



with 98 first-cross Border Leicester-Merino and Lincoln-Merino ewes. The lambs from the Dorset Horn and Ryeland rams showed excellent conformation, and the lambing percentages were 102 and 94 per cent, respectively. Only 11 per cent of lambs were produced by the Southdown rams. The average weights of the Dorset Horn and Ryeland lambs at four months of age were 81 and 80 lbs., respectively, and the Southdowns 67.5 lbs. A similar experiment carried on at the Bathurst farm gave somewhat similar results for the Dorset Horn and Ryeland rams, but the lambing percentages of the Southdown crosses were much better, 110 per cent lambs being marketed. The returns per ewe were slightly greater in this case for the Southdown crosses.

**Dry meal hoppers for pigs,** C. REILLY (*Jour. Min. Agr. [Gt. Brit.]* 29 (1922), No. 9, pp. 816-819, pl. 1).—Experiments in using self-feeders for swine in a commercial Danish herd are reported.

In one test 31 store pigs weighing from 84 to 112 lbs. were placed for 7 days on self-feeders containing different feeds, and the amount of each feed consumed was determined as follows: Mixed meal (corn, wheat, and barley ground together in equal portions) 686 lbs., rice meal 308 lbs., fish meal 112, palm kernel cake 70, whole peas soaked 140, and whole corn 56 lbs. Other tests with self-feeders for store pigs have given good results.

To compare self-feeding with the feeding of a slop for fattening, two lots of 6 pigs each, averaging about 120 lbs. were selected for a 6 weeks' test. The pigs receiving the slop made average daily gains of 1.5 lbs. per head, consuming 4.4 lbs. of feed per pound of gain. The pigs on self-feeders made average daily gains of 2 lbs. and required 4.1 lbs. of feed per pound of gain.

Self-feeding has also been successfully used for sows with pigs and pregnant sows. To prevent fattening in the latter case only palm kernel cake and fish meal have been fed as they are not very palatable. Green feeds were also used.

**Cost of raising young pigs,** J. A. McCLARY (*Canada Expt. Farms, Lennoxville (Que.) Sta. Rpt. Supt. 1922, pp. 14, 15*).—Based on the results of raising the pigs from four Yorkshire sows during the year, it has been calculated that it costs \$3.24 to raise young pigs to weaning age. Eighteen and one-half pigs were raised per year per sow. The cost of labor, interest on the investment, and other items were charged.

**Cure your own pork,** H. H. SMITH (*Colo. Agr. Col. Ext. [Bul.]* 196A (1923), pp. 11, figs. 9).—Directions are given for killing, cutting, and curing pork.

**Whole oats v. chop for horses,** M. J. TINLINE (*Canada Expt. Farms, Scott (Sask.) Sta. Rpt. Supt. 1922, pp. 6, 7*).—In a test lasting 119 days, one horse of each of five teams received whole oats, whereas the other horse received an equal amount of ground oats. The horses receiving the whole oats lost an average of 18 lbs., whereas those receiving ground oats gained an average of 11 lbs. None of the animals were doing heavy work, and some were on pasture during the day and stabled at night.

**Cost of horse labor,** J. A. McCLARY (*Canada Expt. Farms, Lennoxville (Que.) Sta. Rpt. Supt. 1922, p. 12*).—Based on the cost of feed, interest on value of buildings and horses, depreciation in value of horses, shoeing, veterinary fees, and equipment, it was found to cost 13.2 cts. per hour for horse labor by 14 work horses on the experimental farm. Of this cost 6.1 cts. was for feed.

**[Poultry experiments at the Lethbridge Experimental Station],** W. H. FAIRFIELD (*Canada Expt. Farms, Lethbridge (Alta.) Sta. Rpt. Supt. 1922, pp. 69-71*).—Satisfactory profits were made over feed cost on 2- and 3-year-old hens kept until fall before selling. It is suggested that hens to be sold should be



disposed of by the latter part of September, as their egg production usually drops off very rapidly after that.

Fifty pullets hatched during April laid 3,097 eggs during November, December, January, and February and 9,462 during the year, whereas 50 May hatched pullets receiving the same treatment laid 2,040 eggs during the winter and 6,487 during the year.

[Poultry experiments at the Invermere Experimental Station], R. G. NEWTON (*Canada Expt. Farms, Invermere (B. C.) Sta. Rpt. Supt. 1922, p. 35*).—In experiments dealing with the early hatching of chicks, it has been found that eggs laid in March were 88 per cent fertile, but only 38 per cent of the fertile eggs hatched, whereas eggs laid in June were 86 per cent fertile and over 83 per cent of the fertile eggs hatched. The reason given for the difference is the long period of confinement during the winter.

Comparisons of natural and artificial incubation have shown that larger hatches and stronger chicks are hatched by hens than in artificial incubators. Tests of three different types of incubators have shown that the Buckeye gave the best hatches at a lower unit cost. The hatches from the Cyphers were slightly better than those from the Prairie State incubator.

[Poultry experiments at the Morden Experimental Station], W. R. LESLIE (*Canada Expt. Farms, Morden (Man.) Sta. Rpt. Supt. 1922, pp. 70, 71*).—In comparing different methods of incubation, 1,003 eggs incubated in March in Buckeye incubators (hot water heat) were 80.65 per cent fertile, of which 49.81 per cent hatched, whereas the eggs incubated in April in the same machines were 93.87 per cent fertile and 57.64 per cent of the fertile eggs hatched. Eggs incubated the same year during March in the Cyphers (hot air) incubator were 87.21 per cent fertile, of which 63.04 per cent hatched. Those incubated during April in the same machine were 94.31 per cent fertile, of which 61.44 per cent hatched.

In comparing hens and pullets as breeders, 94.32 per cent, 80.17, 84.1, and 92.04 per cent of the eggs laid by Barred Rock hens, Barred Rock pullets, Rhode Island Red hens, and Rhode Island Red pullets were fertile. The hatching percentages of the fertile eggs in each case were, respectively, 54.81, 61.53, 58.53, and 59.34 per cent.

A study of the effect of the month of hatching on the hatching results showed that eggs set in March, April, and May were 84.84, 90.07, and 88.05 per cent fertile, respectively, and that 34.72, 63.24, and 61.35 per cent, respectively, of the fertile eggs hatched.

To compare the amount of feed required to raise Barred Rock and Rhode Island Red chicks from 2 weeks to 4 months of age, the results with 103 Barred Rock and 240 Rhode Island Red chicks were recorded. It required 5.15 lbs. of feed to produce 1 lb. of gain in Barred Rocks and 4.49 lbs. of feed to produce 1 lb. of gain in Rhode Island Reds in the test. The Barred Rocks gained 398 lbs. and the Rhode Island Reds 765 lbs.

[Poultry feeding experiments at the Charlottetown Experimental Station], J. A. CLARK (*Canada Expt. Farms, Charlottetown (P. E. I.) Sta. Rpt. Supt. 1922, pp. 57, 58*).—The values of buttermilk and beef scrap for egg production were compared by feeding two lots of 10 White Leghorn pullets each. Both lots received the same feeds except that one was given beef scrap and the other buttermilk. The lot receiving buttermilk laid 572 and the lot receiving beef scrap 666 eggs in six months, beginning in November.

For comparing home-grown and commercial feeds for egg production, one lot of 10 White Leghorn pullets was fed for six months, beginning in November,



on a scratch feed consisting of home-grown grains and a home-mixed ration. This lot laid 635 eggs as compared with 694 eggs laid by another lot receiving commercially prepared scratch feeds and mash. The high price of the commercial feeds made the cost of production greater in the latter case even though the egg production was higher.

**The digestive coefficients of poultry feeds and rapidity of digestion and fate of grit in the fowl**, B. F. KAUPP and J. E. IVEY (*North Carolina Sta. Tech. Bul.* 22 (1923), pp. 3-143, figs. 13).—This is a detailed report of the studies of the time required for food to pass through the digestive tract and the digestibility of poultry feeds previously noted from other sources (*E. S. R.*, 49, p. 373; 48, p. 573), respectively.

In another experiment the amount of grit present in the gizzards of hens kept in small coops for from 14 to 375 days without access to grit was determined. From the results, the authors conclude that fowls normally consume more grit than they really need, but when they do not have access to a fresh supply sufficient grit is retained in the gizzard for ordinary needs even after one year. The gizzards of 2 birds killed after 14 days contained 9.5 and 13.1 gm. of grit, respectively, whereas other birds killed after 330, 365, and 375 days without grit had 1.9, 2.6, and 5.9 gm., respectively, in their gizzards. There was, however, no regular decrease in the amount of grit found in the gizzard with the time that the birds had been without grit, individuals varying greatly in this respect.

**Economic factors in fattening chickens**, M. A. JULL and W. A. MAW (*Sci. Agr.*, 3 (1923), No. 6, pp. 197-202).—This is an economic consideration of the cost of fattening chickens, based partly on the results of fattening experiments previously reported by the junior author (*E. S. R.*, 47, p. 872) and on additional experiments in which similar rations were used. The percentage gross revenue over the cost of the unfattened birds and the cost of feed was used as the comparative economic factor in each case.

The best results were secured as follows: Large sized birds fattened for 10 days on a ration of 36 parts each of oat meal and corn meal, 18 parts of midlings, 5 parts of beef scrap, and 5 parts of milkstock moistened with water, made a gross revenue percentage of 150.91. Medium sized chickens fattened for 2 weeks on a ration of equal parts of oat meal, corn meal, and buckwheat and 10 per cent of beef scrap moistened with skim milk returned a gross revenue percentage of 149.24.

**The relation of certain blood constituents to a deficient diet**, T. J. THOMPSON and I. L. CARR (*Biochem. Jour.*, 17 (1923), No. 3, pp. 373-375).—Blood drawn with a hypodermic needle from the brachial artery of chickens fed on boiled polished rice, filter paper, and crushed marble was analyzed when the birds were normal and as they developed polyneuritis. In regard to the composition of the blood, the authors state that "in some cases the final value for sugar was greater than normal. In one individual there was a regular increase in the amount of sugar. The nonprotein nitrogen values were somewhat erratic. The uric acid and the creatinin values showed the most regular variation, decreasing at first, then suddenly increasing. Soon after this increase occurred the hen showed signs of polyneuritis."

When polyneuritis started some of the birds were given yeast and recovered, while others were allowed to die. The dead birds showed degeneration of the heart, kidneys, or liver. The tendency of the blood to clot varied widely, but it was so strong when polyneuritis occurred that samples could not be taken. This work was carried on at the University of Nebraska.



**The effect of pituitary feeding on egg production in the domestic fowl,** S. SIMPSON (*Quart. Jour. Expt. Physiol.*, 13 (1923), No. 2, pp. 181-189).—Five experiments modeled after those of Clark (E. S. R., 34, p. 75) in which increased egg production apparently resulted from pituitary feeding were carried on at the Cornell University Medical College. The author, however, found no evidence of marked or significant increased egg production from pituitary feeding in any of the experiments, though pituitary lobes were taken from both mature and growing animals and treated in the same manner as those fed in the experiment mentioned above.

**Further notes on the "winter cycle" in the domestic fowl,** J. A. HARRIS and H. R. LEWIS (*Science*, 57 (1923), No. 1483, pp. 644, 645).—Based on the records of White Leghorns previously noted (E. S. R., 49, p. 273), the authors have reported the 50 coefficients measuring the correlation between the winter, spring, summer, autumn, and annual production of the dams' first year and like periods for the daughters' first year and between the records for the same periods for the dams' second year and the daughters' first year. The correlation coefficients were very small, but they were nearly all positive. The highest coefficient was between the autumn productions of the dams' second year and the daughters' first year,  $+0.2207 \pm 0.0320$ , followed by the coefficient between the autumn productions of the dams' first year and the daughters' first year,  $+0.1991 \pm 0.0323$ . The comparative respective correlation coefficients for the winter productions for the dams and daughters in the two years were  $+0.0578 \pm 0.0335$  and  $+0.1387 \pm 0.033$ . This shows that the highest correlation is not between the winter cycles, but between the autumn cycles.

**Early v. late hatched pullets,** J. A. McCLARY (*Canada Expt. Farms Lennoxville (Que.) Sta. Rpt. Supt.* 1922, pp. 48, 49).—Three years' results in comparing the winter egg production and profit from early and late hatched chicks have shown an advantage in favor of the early hatched pullets each year. The winter eggs laid in the three different years by the early hatched pullets were 750, 1,798, and 1,668, and by the late hatched pullets 736, 1,068, and 1,124.

**What breed of poultry should be raised?** A. MAUMENÉ (*Vie Campagne*, 19 (1923), Feb. 15, pp. 58, figs. 122).—The French, Belgian, Dutch, Italian, Spanish, Central European, English, American, and Asiatic breeds of poultry are briefly described and illustrated. The origin, characteristics, use, and most common faults of each breed are discussed.

**What breed of rabbits will you raise?** A. MAUMENÉ (*Vie Campagne*, 20 (1923), Apr. 15, pp. 58, figs. 109).—The different types and breeds of rabbits are briefly described and illustrated, with discussions of the methods of tanning and utilizing the skins and preparing the meat.

**Buffalo cross breeding,** F. DICKIE (*Natl. Stockman and Farmer*, 47 (1923), No. 11, p. 6, figs. 2).—A brief account is given of breeding experiments with buffaloes and buffaloes crossed with cattle that are being conducted under the direction of the Canadian Government at Wainright Park, Alberta. The buffaloes and crossbreeds are able to withstand cold winters without shelter or extra feed, and it is the belief that such animals may be adaptable to certain regions of northern Canada. A yak bull is also to be used in the investigations.

## DAIRY FARMING—DAIRYING.

**Studies in the growth and nutrition of dairy calves.—VI, The addition of hay and grain to a milk ration for calves,** A. C. McCANDLISH (*Jour. Dairy Sci.*, 6 (1923), No. 4, pp. 347-372, figs. 6).—In further studies of the growth and nutrition of dairy calves (E. S. R., 48, p. 772), six calves were removed from

their dams at a few days of age and divided into three lots. All received whole milk three times daily according to their ability to handle it. Salt was accessible at all times, and in addition lot 2 had access to a grain mixture consisting of 5 parts of cracked corn, 2 parts of ground oats, 2 parts of wheat bran, and 2 parts of linseed oil meal, and lot 3 had access to alfalfa hay.

Weights and measurements of height at withers, depth of chest, and width of hooks were taken at 30-day intervals, and the data are so reported for each animal and compared with like records of 40 normally-fed heifers. The calves in lot 1 were heavier than the average at birth, but one dropped below normal at 2 months and the other at 5 months. The calves in this lot finally got into such a weakened condition that they were given alfalfa hay, beginning with the eighth and sixth periods, respectively, and they immediately began to gain.

One calf in lot 2 behaved much the same as the calves in lot 1 as to gains in weight, and alfalfa hay was given to it during period 6. The other calf made poor gains from the start and finally died on the sixteenth day of period 5. The calves of lot 3 always exceeded the normal rates of growth. The calves in lots 1 and 2 showed a depraved appetite and became weak and restless until the alfalfa hay was supplied. The bones were especially flexible and weak in the calves of lot 2. A complete report of the post-mortem examination of the calf which died is given.

In discussing the cause of the deficiency of milk alone and milk and grain rations, the author shows that the calves receiving milk and grain were getting an ample amount of dry matter and digestible nutrients for growth, but they were not receiving sufficient bulk. A consideration of the lime-magnesium ratio showed that the calves in lot 2 were consuming a ration containing 1 part of CaO to from 0.4 to 0.6 part of MgO during different periods. There was evidence in the calves of lot 2 that such an excess of magnesium resulted in the liberation of calcium from the bones to counteract it, as Forbes has previously found in pigs (*E. S. R.*, 22 p. 771).

In considering the vitamin content of the ration, the author assumes that sufficient vitamin A is present in whole milk and sufficient vitamin B in the grains fed lot 2, and that while green alfalfa hay contains vitamin C, it is destroyed on drying. From this he concludes that the good results in the alfalfa hay lot were not due to any deficient vitamin which it supplied. The benefits of alfalfa hay are attributed to its bulk. The grain produced bad effects because the ration lacked bulk and because of the unsatisfactory calcium-magnesium ratio supplied.

**Feeding and management of dairy calves**, E. V. ELLINGTON and J. C. KNOTT (*Washington Col. Sta. Bul.* 178 (1923), pp. 3-31, figs. 10).—The growth, as determined by live weight, chest measure, and height at withers, made by dairy calves on condensed buttermilk, skim milk, whole milk, powdered skim milk, home mixed calf meal, and two commercial calf meals is noted and compared with the normal growth of dairy heifers as reported by Eckles (*E. S. R.*, 43, p. 876).

In the experiments the calves received whole milk for two weeks and then a gradual change was made to the test feeds as in the portion of this test previously noted (*E. S. R.*, 47, 581). Grain and alfalfa hay were available for



the calves at all times. The results of the experiments are summarized in the following table:

Summary of calf feeding tests.

Feed.	Num-ber of calves.	Average length of ex-peri-ment.	Average daily gain.			Average test feed con-sumed per day.	Average daily con-sump-tion of grain.
			Live weight.	Height.	Chest measure.		
		Days.	Pounds.	Inches.	Inches.	Pounds.	Pounds.
Skim milk.....	11	134	1.67	0.066	0.113	10.3	3.7
Condensed buttermilk.....	8	149	1.43	.067	.112	3.6	3.4
Whole milk.....	2	105	1.24	.073	.116	8.9	1.6
Powdered skim milk.....	3	79	.96	.029	.096	1.5	1.9
Commercial calf meal No. 1.....	4	142	1.12	.056	.097	1.2	2.9
Commercial calf meal No. 2.....	2	120	1.38	.057	.087	2.1	2.8
Home mixed calf meal.....	5	114	1.45	.066	.100	1.7	3.0

The general principles of calf feeding, diseases, and sanitation are also discussed in the bulletin.

**Feeding and management of dairy cattle**, J. R. DICE (*N. Dak. Agr. Col. Ext. Circ. 51* (1923), pp. 68, figs. 25).—Popular directions for feeding, managing, and breeding dairy cattle are discussed, and a chapter by D. McMahan dealing with the common ailments of dairy cattle is included.

**A possible factor influencing the assimilation of calcium**, C. H. HUNT, A. R. WINTER, and R. C. MILLER (*Jour. Biol. Chem.*, 55 (1923), No. 4, pp. 739–742).—More detailed results of the experiments previously noted (*E. S. R.*, 49 p. 675).

**Investigations of milk secretion**, A. DYSSEGAARD (*K. Vet. og Landbohøjsk. [Copenhagen]*, *Aarsskr. 1923*, pp. 103–164, figs. 4).—In studying the milk secretion during different intervals, catheters were inserted in the teats of 4 goats by making slight incisions through the wall into the milk cistern. The milk was then drawn off into bottles, and analyses were made at various periods. Another method of studying the milk at different times was by milking 2 goats and 4 cows at various periods from 2 to 12 times daily. The cows were milked regularly every third hour, day and night for 10 days.

The milk secretion of both the cows and the goats was found to be extremely variable during different parts of the day by both methods of investigating. The amount of milk seemed to vary most and the fat percentage was somewhat less variable, whereas the content of protein, sugar, and ash were more nearly constant. The amount of milk produced by the cows increased greatly from 3 to 6 a. m., with a slight increase during the period from 3 to 6 p. m., but no such uniform results were observed in the goats. The fat percentage of 3 of the cows was greatest from 3 to 6 p. m., but it was lowest for all from 12 m. to 3 a. m.

The author states that a positive correlation was calculated between the amount of milk and the fat percentage, though this was not uniform in all cases. No change in the milk production was noted from the frequent emptying of the udder by milking or the constant draining of the udder by a catheter.

A study of the effect of subcutaneous injections one-half hour before milking of pituitary extract, adrenalin, placenta extract, and extract of mammary gland indicated that pituitary extract and placenta extract tended to decrease the secretion of milk, whereas the adrenalin did no perceptibly decrease the secretion, nor did the extract of the mammary gland increase it. The detailed results of the experiments are presented in tabular form. An English abstract is also appended.

**The effect of gestation on the rate of decline of milk secretion with the advance of the period of lactation**, S. BRODY, A. C. RAGSDALE, and C. W. TURNER (*Jour. Gen. Physiol.*, 5 (1923), No. 6, pp. 777-782, figs. 2).—In continuing the study of milk secretion (*E. S. R.*, 49, p. 375), the effect of gestation on milk secretion was determined by comparing the milk records of Guernseys which were not bred with those of other Guernseys which were bred during the third and fourth months after calving.

From these data it is evident that the milk production of the farrow cows follows the course of decline of a monomolecular chemical reaction, but the production of the pregnant group declines more rapidly, especially after the fifth month of gestation. The same conclusions were evidenced by a comparison of the production of Guernsey cows during the tenth and twelfth months of lactation with the body weight of Jersey cows during different periods of gestation. A graphical presentation of this comparison showed that the milk flow decreased as the body weight increased due to the advance of the gestation period.

**Milk recording and feeding for milk and butter**, J. MACKINTOSH (*Jour. Roy. Agr. Soc. England*, 83 (1922), pp. 44-60).—A general discussion is given of the value of milk recording as it assists practical dairymen in increasing the production of their herds and the adoption of more economical feeding methods.

**Milk: Its quality and adulteration**, F. W. F. ARNAUD (*Jour. Roy. Agr. Soc. England*, 83 (1922), pp. 60-72).—This is a discussion of the variation occurring in the composition of normal milk from individual cows and herds during different seasons. Data presented show that the fat content is decidedly variable for the same animals, whereas the percentage of solids-not-fat seems to be more constant except for some slight seasonal variation. Lower percentages of solids-not-fat occur more frequently during a dry summer. The fat percentage shows a decided seasonal variation. The highest percentages occur during October, November, December, January, and February, with a gradual drop from March to June, followed by a regular increase. Without adulteration the experiments have shown that the milk of some cows and even of some herds may fall below the minimum requirement of 3 per cent fat and 8.5 per cent solids-not-fat.

**Simple milk formulas**, D. W. HORN (*Science*, 57 (1923), No. 1487, pp. 748, 749, fig. 1).—The author suggests two rules for detecting skimmed or watered milk, derived from Fleischmann's formula for determining the specific gravity of milk solids, Babcock's formula for the percentage of total solids, and Bialon's formula for the specific gravity of fat-free milk. The minimum fat percentage to be expected in milk may be detected by adding 3 to the lactometer reading and dividing this by 10. The expected fat percentages of milk above suspicion of watering are whole numbers ranging from 2 to 6 when the lactometer readings are arranged in descending order from 30 to 26.

**The colorimetric H-ion determination as a means of locating faulty methods at city milk plants**, L. H. COOLEGE (*Michigan Sta. Spec. Bul.* 124 (1923), pp. 3-19, figs. 4).—Samples of milk at dairies were tested at intervals before, during, and after pasteurization by the colorimetric H-ion method previously employed (*E. S. R.*, 47, p. 281), and the relation to the actual keeping quality and bacterial content of the milk was determined with some of the samples. The results demonstrated the applicability of this test for use in locating improper pasteurization or contamination in some part of the dairy.



**Model regulations.—XIX, Dairies, cowsheds, and milk shops** (*London: [Gt. Brit.] Min. Health, 1922, pp. 15*).—This consists of a copy of the regulations governing dairies, dairy barns, and milk shops in England.

**The streptococci of souring milk**, S. H. AYERS and C. S. MUDGE (*Abs. Bact.*, 7 (1923), No. 1, pp. 11, 12).—This is an abstract of a study of the streptococci content of souring milk. It was found that *Streptococcus lactis* and *S. kefir* were practically the only types present. The proportions of the different types of streptococci were found to vary according to the acid content of the samples of milk examined. In milk containing from 0.18 to 0.25 per cent lactic acid, the streptococci consisted of 27.7 per cent *S. lactis*, 67.4 per cent *S. kefir*, and 4.9 per cent miscellaneous types. The respective ratios in milk containing from 0.3 to 0.49 per cent of lactic acidity were 59, 41, and 0, whereas in milk containing more than 0.6 per cent of lactic acidity, 92.3 per cent of the streptococcus cultures were of the *lactis* type and 6.7 per cent of the *kefir* type.

**The production of volatile fatty acids and carbon dioxid by propionic acid bacteria with special reference to their action in cheese**, R. H. SHAW and J. M. SHERMAN (*Jour. Dairy Sci.*, 6 (1923), No. 4, pp. 303-309).—Observations at the Dairy Division, U. S. D. A., on the action of *Bacterium acidipropionici* (d), the causal factor in the production of eyes and flavor in Swiss cheese, have shown that the organism can produce carbon dioxid, propionic acid, and acetic acid from lactose, lactic acid, succinic acid, glycerol, peptone and butterfat. The tests were made on media consisting of 1 per cent of peptone and 2 per cent of the tested substance. The organic acids tested were in the form of their calcium salts. Sodium asparaginate was also found to be a source of acetic acid and carbon dioxid.

**The fishy flavor in butter**, H. H. SOMMER and B. J. SMIT (*Wisconsin Sta. Research Bul.* 57 (1923), pp. 51).—This is a more complete report of the investigation previously noted (*E. S. R.*, 49, p. 679) and by Johnstone (*E. S. R.*, 49, p. 176). In studying the conditions which favor fishiness in butter, 400 lbs. of sweet cream was divided into 10 lots of 40 lbs. each and the different lots churned as follows: Four lots were churned raw, 1 of which was unripened, 1 naturally ripened to 0.4 per cent acidity, and 2 naturally ripened to 6 per cent acidity, 1 of which was neutralized to 0.25 per cent acidity with sodium bicarbonate. Six lots were pasteurized, 4 of which were treated in the same way as the 4 raw samples except that starter was used in the ripening. The other 2 pasteurized samples were ripened to 0.4 and 0.6 per cent acidity before pasteurization. The butter made from each lot of cream was further divided into 7 parts and treated as follows: One part was unsalted, 1 was medium salted (1.5 per cent salt), and 5 parts were highly salted (3 per cent salt). To 3 of these 0.1 per cent ferric oxid, ferrous lactate, or tin lactate, respectively, were added, and one of the highly salted parts was overworked. One-half of the butter from each of the 7 parts of each of the 10 lots was stored at 10° F. for 8 months and scored at intervals, whereas the other half was stored at from 35 to 40°.

The results indicated that true fishiness occurred almost entirely in the unpasteurized samples and mostly then in the highly salted butter containing the ferric oxid or ferrous lactate which was ripened to 0.6 per cent acidity without neutralization. Overworking also tended to cause fishiness and oily flavors. Pasteurization after ripening, neutralization, and low storage temperature were apparently effective in checking the production of fishiness. No oily or fishy flavors developed in samples of unsalted butter.

A review of the literature indicates that trimethylamin resulting from the oxidation of lecithin is the most likely cause of fishiness, therefore emulsions



containing 0.1 per cent of lecithin prepared from egg yolk were modified similarly to butter by salting, acidifying with lactic acid, and adding ferrous lactate or hydrogen peroxid to different samples. These samples were incubated at 35° C. for 6 weeks and analyzed for the presence of trimethylamin expressed as the percentage of the total amount which might result from the oxidation of the lecithin present. The results of this experiment and a repetition of it in which mercuric chlorid was used as a preservative and in which additional tubes were used having the air replaced by oxygen above the samples showed that acidity, salt, and oxidation play an important part in the decomposition of lecithin into trimethylamin, and that the prevention of bacterial growth did not stop the action. The addition of 100 parts of trimethylamin lactate to 1,000,000 parts of butter caused a fishy flavor, and chemical analysis showed that fishy butter contained trimethylamin, but that it was absent in fresh butter.

Salted butter made from cream to which lecithin and lactic acid had been added developed more fishiness than butter made from similar cream without lecithin. Other experiments indicated that *Bacterium ichthyosmius* and a fishy cream organism can produce trimethylamin under favorable conditions not only from lecithin but also from proteins. The bacterial action is inhibited, however, in the presence of salt or lactic acid, or at the usual storage temperatures for butter. Larger amounts of hydrolyzed lecithin were decomposed into trimethylamin by both chemical and bacterial action than occurred when unhydrolyzed lecithin was used. The results of the tests with lecithin thus show that it is decomposed into trimethylamin under much the same conditions as fishiness develops in butter. This is probably a chemical reaction, but may also result from bacterial action on proteins.

The results of the experiment are fully discussed in relation to the literature cited in the bibliography of 136 references.

**Bacteriological studies of ripening in brick cheese,** S. FILIPOVIĆ (*Centbl. Bakt. [etc.]*, 2. Abt., 58 (1923), No. 1-3, pp. 9-41).—The different types of bacteria and the respective amounts of each found in brick cheese during the different stages of ripening are reported and tabulated with reference to those responsible for the production of desirable and undesirable flavors, odors, and colors.

**The utilization of whey, I-III** (*Jour. Roy. Agr. Soc. England*, 83 (1922), pp. 73-96, figs. 2).—Three papers dealing with the utilization of whey are presented.

I. *Introduction*, C. D. Whetham (pp. 73-77).—The values of the lactose and lactalbumin which are present in the whey produced in Great Britain are cited, and a discussion is given of the problem of disposing of whey from cheese factories. Plans for the investigational work reported in the succeeding papers are noted.

II. *A soluble lactalbumin from whey*, C. P. Stewart (pp. 77, 78).—A water-soluble lactalbumin was produced from whey by first precipitating the albumin by heating to 95° C. The precipitate was then filtered off, and the moistened coagulum was dissolved in an excess of alkali and reprecipitated by hydrochloric acid. This precipitate was filtered off, washed to remove any sodium chlorid, and ground to a paste with sodium hydroxid. The product was then dried. This substance, which was really the meta-protein, was soluble in water and contained 2 per cent of sodium hydroxid.

III. *The extraction of lactose and lactalbumin from fresh and from condensed whey*, L. Harding (pp. 78-96).—After briefly reviewing the methods of other investigators, the author suggests the following procedure for separating lactose and lactalbumin from whey: Titrate 25 cc. of whey with N/10 alkali,



using phenolphthalein as indicator. To remove the protein the chemical equivalent in precipitated calcium carbonate of the number of cubic centimeters minus 3 of alkali required for neutralization should be added to the whey at 70° C. The material is then to be heated to from 80 to 85° for 7 minutes and filtered. Clarification of the filtrate is brought about by heating to from 65 to 70° and adding 6 lbs. of calcium carbonate and 8 lbs. of aluminum sulphate per 100 gal. The material should then be filtered, and the lactose may be recovered from the filtrate by evaporation at 60° in a vacuum pan to a density of 1.2. By standing 24 hours the lactose crystallized and an analysis showed that the crystals were 96 per cent pure lactose.

Dried whey was found unsatisfactory for use in the manufacture of lactose when drying occurred on rollers, and the results of drying in a vacuum pan at 60° were uncertain. Concentration of the whey in the form of a sirup seemed to offer possibilities, however. In experiments on a factory scale whey was found to yield 65 per cent of dry albumin and 4.12 per cent of sugar. The estimated cost of production of lactose was about 8d. per pound.

A plan for the national utilization of whey is recommended which consists of condensing the whey to a specific gravity of 1.26 at each factory. This sirup would then be delivered to a central factory, where experiments have shown that lactose and albumin of good quality may be recovered. The cost of producing 1 lb. of condensed whey was calculated at 2½d. per pound.

**The acidity problem in the ice cream industry,** B. I. MASUROVSKY (*Ice Cream Rev.*, 7 (1923), No. 2, pp. 58, 60).—In a test at the University of Nebraska of the effect of the acidity of ice cream on its flavor, viscosity, and overrun, mixes were prepared, pasteurized, and homogenized, and butter starter was added to one-half of them. The mixes were then aged 2, 3, 19, 43, 48, and 72 hours before freezing. The acidity of the mixes to which no starter was added varied from 0.12 to 0.13 per cent, and those to which starter had been added varied from 0.23 to 0.37 per cent. The lactic acid flavor of the acidified mixes was especially pronounced immediately after freezing, but this flavor was diminished by allowing the ice cream to stand in the hardening room. The viscosity of the ice cream was increased by an increase in the acidity, but there was practically no effect on the overrun.

**The composition and manufacture of ice cream,** O. E. WILLIAMS (*Creamery and Milk Plant Mo.*, 12 (1923), No. 6, pp. 79, 80, 82).—Essentially the same material as was previously noted (E. S. R., 49, p. 579).

## VETERINARY MEDICINE.

**The nutritional values of heated blood agar,** M. B. SOPARKAR (*Indian Jour. Med. Research*, 11 (1923), No. 2, pp. 421-428).—Blood heated at from 67 to 70° C. for 10 or 15 minutes is reported to have maximum growth-promoting properties for *Bacillus influenzae* (Pfeiffer) in blood agar media. Attention is called to the theory advanced by Fildes (E. S. R., 46, p. 79) that the feebleness of growth of the microorganism on unheated blood as compared with heated is due to the deviation of oxygen from the bacillus to the hemoglobin, and it is pointed out that at 70° hemoglobin is decomposed into hematin and globin, thus removing the inhibiting substance.

The experiments reported are also thought to demonstrate that the thermolabile factor in blood is more susceptible to the destructive action of heat than was reported by Thjötta and Avery (E. S. R., 46, p. 78).

**Desiccated nutrient media,** A. C. VARDON (*Indian Jour. Med. Research*, 11 (1923), No. 2, pp. 429-432).—Brief directions are given for the preparation of



desiccated nutrient agar, simple bouillon, Loeffler's medium, and Aronson's medium, and for the subsequent preparation of the dried media for use.

**The influence of age and temperature on bacterial vaccines, III,** W. F. HARVEY and K. R. K. IYENGAR (*Indian Jour. Med. Research*, 11 (1923), No. 1, pp. 110-112).—Continuing the series of studies previously noted (E. S. R., 48, p. 277), the authors have tested the stability of fowl cholera vaccine under conditions of alternating temperatures of 37 and 18° C.

It was found that the vaccines prepared and tested as in the previous studies did not deteriorate in antigenic value when subjected 24 hours at a time for a month to these two temperatures. It is concluded that fowl cholera vaccine and probably other vaccines will not deteriorate with age or with the varying temperatures to which they may be exposed within reasonable periods.

**Immunization by reinoculation, after a long interval, with a diminished dose of vaccine,** W. F. HARVEY and K. R. K. IYENGAR (*Indian Jour. Med. Research*, 11 (1923), No. 2, pp. 437-440).—Further indication that immunity to specific organisms can be reestablished after a long interval by a dose of vaccine much smaller than the one originally administered (E. S. R., 47, p. 484) is furnished by the results of experiments in which pigeons which had previously been immunized by fowl cholera vaccine but had lost the immunity were inoculated with doses of  $\frac{1}{8}$ ,  $\frac{1}{16}$ , and  $\frac{1}{32}$  of the original minimum protective dose. In the case of the first two dilutions, as great a degree of immunity was secured as with the original protective dose.

**On the relation between size of prophylactic dose and protection,** W. F. HARVEY and K. R. K. IYENGAR (*Indian Jour. Med. Research*, 11 (1923), No. 1, pp. 113-118).—With a double prophylactic dose as the basis, as previously recommended (E. S. R., 48, p. 278), the effect was studied of altering the amount of the dose within quite a wide range. The two points considered were the possible toxic effect of large doses and the degree of protection afforded by doses of different size. Pigeons were again used as the experimental animals and fowl cholera vaccine as the immunizing agent.

It was found that the range of dosage within which maximum protection was secured was fairly large, lying between 0.125 and 1 mg. of the dried substance. With doses lying on either side of this range, the degree of protection afforded was much smaller. It is thought to be a matter of considerable importance to determine as closely as possible the optimum size of dose to produce maximum protection.

**On immunization with relatively avirulent living organisms,** W. F. HARVEY and K. R. K. IYENGAR (*Indian Jour. Med. Research*, 11 (1923), No. 2, pp. 433-436).—A comparison is reported of the immunizing value for pigeons of living, relatively avirulent strains and dead, virulent strains of fowl cholera bacilli. It was found necessary to use much smaller amounts of the living bacilli than had been shown in the above paper to give optimum results with dead organisms. The minimum lethal dose of the strain used was found to lie between 0.02 and 0.1 mg. (expressed in terms of dried bacterial substance). Both the living and the dead organisms were consequently administered intravenously in two portions of 0.004 and 0.008 mg., respectively, at an interval of 7 days and the test dose of living organisms administered 14 days later.

In both cases there were 3 survivors out of the 10 pigeons used. This is thought to indicate that there is no difference in the activity of the prophylactic vaccine of living, relatively avirulent organisms and of dead, virulent organisms, at least for the particular strain used in the experiment.

**The pharmacology and toxicology of carbon tetrachlorid,** P. D. LAMSON, G. H. GARDNER, R. K. GUSTAFSON, E. D. MAIRE, A. J. MCLEAN, and H. S. WELLS (*Jour. Pharmacol. and Expt. Ther.*, 22 (1923), No. 4, pp. 215-288, figs. 32).—This



is a report of extended studies conducted by the authors at Johns Hopkins University. In the course of the investigation, approximately 4,000 pathological sections were made of the tissues in different conditions of intoxication after carbon tetrachlorid, the details of which will be reported upon later.

"Pure carbon tetrachlorid has been found to be relatively nontoxic for dogs when given in single doses by mouth, even up to 25 mils/kilogram (500 times the therapeutic dose). In a series of 35 dogs given 100 to 500 times the therapeutic dose only 1 dog died. No marked symptoms of intoxication could be observed after any of these doses, but that a certain degree of intoxication occurs is evidenced by slight nervous symptoms and pathological changes in the liver with even small doses. Approximately 100 times the therapeutic dose was found necessary before a change in the phenoltetrachlorphthalein curve was observed. Repeated doses of 25 cc. per kilogram (as much as 220 cc. daily) have been given to dogs over several days. As much as 2 liters have been given before severe symptoms occurred in 1 animal. Carbon tetrachlorid may be considered an extremely safe anthelmintic for dogs if given in single therapeutic doses by mouth with proper precautions."

The authors have confirmed the findings of Hall and Shillinger (E. S. R., 49, p. 76) that carbon tetrachlorid is very toxic to rabbits when given by mouth, death occurring after 4 cc. per kilogram. "The difference in toxicity of carbon tetrachlorid for dogs and rabbits may be due to a difference in degree of absorption from the intestinal tract, as both species of animals are equally susceptible to the drug administered by inhalation. From the great difference in toxicity of pure carbon tetrachlorid in dogs and rabbits it is evident that it is unsafe to infer from experiments on any one species of animals the toxicity for another, as, for example, the toxicity in man from these experiments on dogs.

"The administration of carbon tetrachlorid by mouth after giving digestible fatty substances such as olive oil or cream increases the degree of intoxication, as shown by signs and symptoms [A-A. H.], van den Bergh's bilirubinemia test, pathological findings, and the phenoltetrachlorphthalein liver function test. The administration of alcohol together with carbon tetrachlorid by mouth increases the degree of toxicity of carbon tetrachlorid enormously, death occurring in many animals, and all the symptoms of intoxication, as jaundice, bilirubinemia, bilirubinuria, vomiting, and depression, as well as pathological findings and liver function changes being markedly increased. Puppies were found to be much more susceptible to carbon tetrachlorid than full grown dogs. The increase in degree of intoxication in these conditions is thought to be due to a greater degree of absorption of carbon tetrachlorid for: (1) Although the absorption of carbon tetrachlorid from the intestinal tract has thus far not been demonstrated chemically on account of the absence of perfected methods (now under investigation), carbon tetrachlorid has been detected repeatedly in the breath of dogs given this drug by mouth or by rectum. (2) Signs and symptoms similar to those occurring after oral administration have been observed after both intravenous injection and inhalation of carbon tetrachlorid vapor. . . .

"In the 200 dogs autopsied no worms were found in the intestines of dogs having received carbon tetrachlorid by mouth, in doses above 0.05 mil/kilogram, while many were found in the untreated animals. A method of indicating the course, intensity, and duration of intoxication as well as a numerical method of expressing and comparing total intoxications is described. A summary of the results of the toxicity experiments is given."

A list of 20 references to the literature is included.



**A new organic mercury compound with powerful germicidal properties,** G. W. RAIZISS and M. SEVERAC (*Jour. Lab. and Clin. Med.*, 9 (1923), No. 2, pp. 71-80).—The authors' studies show that 4-nitro-3, 5-bisacetoxymercuri-2-cresol, for convenience designated by them as "Metaphen," possesses certain superior properties, as follows: "(1) It is a very powerful germicidal substance, particularly against staphylococci. (2) It has a comparatively high bichlorid of mercury index. (3) It does not precipitate proteins in as high concentration as 1:200, while the maximum concentration for all practical purposes should not exceed 1:1,000. (4) It practically does not irritate the skin or mucous membranes; nor does it tarnish surgical instruments. (5) It has a low toxicity when administered intramuscularly. (6) It possesses powerful spirocheticidal properties. (7) Because of its high destructive effect upon bacilli and its many favorable biologic properties, it should find practical applications in therapy."

**Paths of infection in experimental anthrax,** A. BACHMANN, P. BELTRAMI, and A. ROMAT (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 34, pp. 1122, 1123).—Contrary to the conclusions reported by Besredka (*E. S. R.*, 46, p. 375) and verified by Balteano (*E. S. R.*, 48, p. 878) that in guinea pigs the skin alone is sensitive to anthrax infection, the authors report that they have succeeded in infecting rabbits and mice by intravenous or subcutaneous injection of anthrax virus without infection of the skin. It is suggested that the difference in results may be due to a difference in the strains employed.

**A case of blacktongue, with post-mortem findings,** J. GOLDBERGER, W. F. TANNER, and E. B. SAYE (*Pub. Health Rpts. [U. S.]*, 38 (1923), No. 46, pp. 2711-2715).—The authors report clinical and epizootological notes and the gross post-mortem findings in a case of blacktongue recently observed in a female foxhound in Georgia. As in the cases previously reported by Wheeler et al. (*E. S. R.*, 47, p. 285), the pathological symptoms showed a striking similarity to those of pellagra. The condition, which proved fatal, developed immediately after the severe exertion of a fox chase. For six weeks previously the dog had been on a restricted diet, about half of the table scraps and meat of the usual diet being substituted by corn bread. A similar dietary restriction the previous year had been followed by a similar attack.

**The comparative sensitiveness to tuberculin of rabbits inoculated with dead tubercle bacilli and with avirulent tubercle bacilli,** A. BOQUET and L. NÈGRE (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 33, pp. 1025, 1026).—Two groups of eight rabbits each were injected intravenously with tubercle bacilli killed by sterilization for 30 minutes at 120° C. and with living bile-treated bacilli, respectively, in doses of 0.01, 0.1, 1, and 10 mg. Thirty days after the injection and once each month thereafter each rabbit was tested by the intravenous injection of 0.025 cc. of crude tuberculin diluted with 1 cc. of physiological salt solution.

In the series treated with dead bacilli, the two rabbits receiving 0.01 and the two receiving 0.1 mg. showed no thermal reaction. The two receiving 1 mg. showed a slight elevation of temperature after each test for six months and on autopsy showed tubercle nodules in the lungs. One rabbit receiving 10 mg. responded to each of four injections of tubercle bacilli with a temperature rise of from 1.2 to 1.9°. After the fifth injection the temperature rose only 0.7° and remained normal after the succeeding injections. In the series treated with living bacilli one of the two receiving 0.01 mg. reacted to each injection and all of the others reacted in varying degrees, thus showing that the bile-treated living bacilli have greater sensitizing properties than the killed bacilli.

**Avian diphtheria,** R. ABBY (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 33, p. 1057).—In the course of an epidemic of avian diphtheria the cultural ex-



amination of the false membranes showed in 10 per cent of the cases examined pure cultures of a Gram-negative microorganism taking the form of a short bacillus or cocco-bacillus, in 60 per cent of the cases these microorganisms in association with various others, in 10 per cent no microorganisms, and in 20 per cent a predominance of yeast. The same Gram-negative microorganism was isolated from 3 per cent of the blood cultures of the birds in which the microorganism had been found in the false membrane.

**Study of a bacillus isolated from the lesions of the mucous membrane and the heart blood during the course of an epidemic of avian diphtheria.**—Attempts at vaccination, R. ABRY and E. FOUREST (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 33, pp. 1058, 1059).—The cultural properties are described of the Gram-negative microorganism noted above, and the results are reported of inoculation and immunization tests.

A small quantity of a fresh culture caused the death of mice in from 12 to 14 hours, and the microorganism could be recovered from the heart blood. Inoculation into guinea pigs produced variable results depending upon the site of inoculation—intramuscularly by an abscess producing a necrotic focus and intraperitoneally by severe reaction, followed by death in 16 hours. In the latter case all of the subdiaphragmatic organs were found on autopsy to be covered with a typical false membrane. The microorganism appeared to form only a small amount of toxin.

The best results in immunization were secured by the use of cultures obtained by intraperitoneal passage in guinea pigs. The cultures thus obtained were killed by chloroform and injected intramuscularly or subcutaneously in doses of between 500 millions and one billion at intervals of 8 to 10 days. The vaccine gave the best results when used as a preventive measure, but if administered in the early stages of the disease often gave favorable results.

**Bacillary white diarrhea of chicks** (*Illinois Sta. Circ.* 273 (1923), pp. [4], figs. 5, plus insert).—This is a brief statement of the cause of white diarrhea of chicks, its recognition, and means of control. Notice is given that the laboratory of animal pathology and hygiene of the University of Illinois is prepared to make a limited number of serum agglutination tests for the detection of infected fowls for owners of breeding stock, and instructions for collecting blood samples from breeding stock for diagnosis of the disease are given in an insert. The circular includes figures in colors of the normal ova of a healthy hen and of ova harboring *Bacterium pullorum*.

## RURAL ENGINEERING.

**Selected list of references relating to irrigation in California**, R. VENABLE (*California Sta. Circ.* 260 (1923), pp. 62).—This list of references includes publications from the U. S. Government, from the State of California, and from engineering societies and organizations. The list is confined to publications issued by public or semipublic agencies or institutions, and textbooks are not included. An appendix contains a supplemental list of publications on irrigation investigations by the U. S. Department of Agriculture of general application to California and a list of important Government and State of California publications issued subsequent to the completion of the preceding list.

**Drainage and supplemental irrigation for the Willamette Valley in Oregon**, W. L. POWERS (*Agr. Engin.*, 4 (1923), No. 8, pp. 125-127, 134, 135).—In a contribution from the Oregon Experiment Station, a summary of data is given obtained from experiments on drainage and supplemental irrigation conducted in the Willamette Valley.



**Revenue report on the irrigation works of the Ajmer-Merwara District for the year 1921-22**, C. C. WATSON ET AL. (*Ajmer-Merwara Irrig. Works Rev. Rpt.*, 1921-22, pp. 19, pls. 2).—This report contains a large amount of tabular data for the year 1921-22.

**Reservoir loses 84 per cent of storage capacity in nine years**, T. U. TAYLOR (*Engin. News-Rec.*, 91 (1923), No. 10, pp. 380-382, fig. 1).—In a contribution from the University of Texas, data on measurements of silt behind the old and new Austin dams in 1900 and 1922 are presented and discussed. These show that the silting up of the reservoir formed by the new dam across the Colorado River at Austin, Tex., decreased the storage capacity by 83.84 per cent in the 9 years ended in the summer of 1922, as compared with a decrease of 62 per cent behind the first dam in the 4 years ended May, 1897, and 52 per cent for the 6.75 years from May, 1893, to January, 1900.

**Economies in canal cleaning, Boise project, Idaho**, C. L. TUCKER (*Reclam. Rec. [U. S.]*, 14 (1923), No. 7, pp. 244-247, figs. 2).—The system used in the canal cleaning work on the Boise project of the U. S. Reclamation Service in Idaho is briefly described, particular reference being made to the manner in which the work is directed. Tabular and graphic data showing canal cleaning costs are included.

**The engineering of excavation**, G. B. MASSEY (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1923, pp. VI+376, pls. 13, figs. 232).—This book consists largely of information on present-day excavating methods and machinery, and contains a large number of photographic and diagrammatic illustrations. It contains chapters on large revolving, standard, and small revolving shovels; the dragline and tower excavators; dry-land dredges; trench digging machines; buckets, transportation; hydraulicking; drilling and blasting; hydraulic, dipper, bucket, and clamshell dredges; scows and barges; dredge hulls (computation and construction); boilers, fuel, electric drive, and wire rope; and application of machinery to work.

**Structural members and connections**, G. A. HOOL and W. S. KINNE (*New York and London: McGraw-Hill Book Co., Inc.*, 1923, pp. XVIII+611, figs. 388).—This volume is one of a series intended to provide a reference work covering thoroughly the design and construction of the principal kinds and types of modern civil engineering structures. An effort has been made to give such a complete treatment of the elementary theory that the book may also be used for home study. Sections are included on general theory, design of steel and cast-iron members, splices and connections for steel members, design of wooden members, splices and connections for wooden members, and design of reinforced concrete members.

**The design of reinforced concrete retaining walls**, A. C. HUGHES (*Surveyor and Munic. and County Engin.*, 64 (1923), No. 1645, pp. 63-66, figs. 4).—A mathematical analysis of this problem is presented.

**Modern roads**, P. LE GAVRIAN (*Les Chaussées Modernes. Paris: J.-B. Baillière & Son*, 1922, pp. 431, figs. 88).—This is a number of the encyclopedia of civil engineering and public works published under the direction of Mesnager. It is divided into two parts. Part 1 deals with bituminous materials, their manufacture and testing for use in road building, and part 2 with the construction of roads and road surfaces.

**What happens when the tire hits the road** (*Sci. Amer.*, 129 (1923), No. 3, p. 172, figs. 2).—This is a brief summary of the results of some of the studies being conducted by the U. S. D. A. Bureau of Public Roads on the impacts from potholes and obstructions in roads with different types of truck tires. Everything indicates that the pneumatic tire has greater cushioning effect, can



be operated over an open stretch of road in a shorter time, and does less damage to road and vehicle than either solid or cushion tires.

**Power alcohol from calcium carbid**, R. FURNESS (*Chem. Age* [London], 8 (1923), Nos. 196, pp. 280, 281; 197, pp. 304, 305).—It is stated that if cheap electrical power were available the production of extremely large quantities of power alcohol in England would be possible, using calcium carbid as a source of alcohol. This would include the cycle of operations from carbid through acetylene and acetaldehyde to alcohol. The process of manufacture is discussed in some detail.

**Electricity on the farm—a bibliography** (*Elect. World*, 82 (1923), No. 7, pp. 333-335).—This is a bibliography of published material on the use of electrical energy on the farm, which was prepared by the American Society of Agricultural Engineers.

**Demonstration of farm tractors and tractor implements**, R. STANFIELD ET AL. (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 35 (1923), pp. 163-234, figs. 47).—A detailed report is given of a demonstration of farm tractors and tractor implements, held October 17-20, 1922, in Scotland.

The results of the demonstration are taken to indicate that a minimum of 25 b. h. p. is desirable for a farm tractor in order that it may be able to draw a 3-furrow plow under ordinary conditions or a cultivator to a proper depth. No advantage was apparent in the use of spring connections and release devices between the tractor and plow. The use of a wooden peg which sheared through under excessive strain appeared to be the most popular method of release. The use of an adjustable hitch, fitted either to the tractor or the implement, was used with advantage.

With reference to implements, in view of the varying conditions of soil in Scotland, plows that are not adjustable are considered unsuitable. In this connection it was noted that a tractor plow covering two or three furrows required more adjustment than a horse plow. Plows fitted with revolving disks and skim coulters were in no case capable of effectively paring the turf from the edge of the furrow slice and laying it in the furrow bottom in such a way as not to interfere with the proper packing of the plowing. In most cases the skimmed portion was merely folded over and left in such a position that the furrows could not be compactly put together.

**Rear axles for trucks**, E. FAVARY (*Jour. Soc. Automotive Engin.*, 13 (1923), No. 2, pp. 151-166, figs. 34).—The five types of final drive now in use on motor trucks are stated by the author to be chain and sprocket, bevel gear, worm gear, double reduction, and internal gear. The advantages and disadvantages of each type are enumerated. The bearing loads and shaft stresses of typical semi-floating and full-floating axles are calculated for maximum torque plus the normal radial load on the wheel, the wheel locked and skidding forward when the brakes are applied, and the wheel skidding sidewise while the truck is moving.

The results are taken to indicate that, while the maximum shaft stresses are practically the same in both designs, the shaft in the full-floating axle can be made lighter, and that a higher factor of safety should be employed in the semi-floating axle since the bending stresses are continually reversed. As the bearing loads in the full-floating axle are considerably higher, a greater bending moment is imposed upon the axle housing, thus increasing the production cost of this axle.

Numerous photographs and drawings of various types of truck rear axles are included.



**The use of the combined reaper-thresher, J. G. TAGGART** (*Canada Expt. Farms, Swift Current (Sask.) Sta. Rpt. Supt. 1922, pp. 10-13, figs. 2*).—Data on the use of the combined reaper-thresher in western Canada are summarized in this article. The crop used for the first part of the test was a 30-acre field of Marquis wheat, the straw of which averaged 36 in. in length. The yield of grain was 39 bu. per acre. The bulk of the grain was harvested in two days and stored in a bin as it came from the combine. A thermometer was kept in the bin, and at no time did the temperature rise above 95° F.

The daily maximum temperatures of the air outside the granary were between 85 and 90°. It is considered doubtful if the wheat would have been acceptable for sale on account of the percentage of soft kernels, although after four months of storage it did not show any signs of deterioration. While there was some shattering of the standing crop when it was approaching the degree of ripeness essential to the satisfactory use of the combine, the loss from this cause was very little more than in the field which was cut with the binder. There was less wheat lost where the combine was used than where the binder was used.

The results are taken to indicate that if conditions prove to be satisfactory for the use of the combine, its use will reduce the cost of harvesting and eliminate a great part of the trouble now experienced in securing harvest help. Leaving a long stubble and depositing the straw on the ground is regarded as a somewhat doubtful advantage in some cases. Certain obvious disadvantages of the combine are loss by shattering due to the necessity of allowing the crop to stand until it is hard in the head, the possibility of loss by hail, snow, or rainstorms, the danger of spoilage after the grain has been binned, and the possible refusal of the grain trade to accept wheat direct from the combine.

**A new dynamometer for testing horses, E. V. COLLINS** (*Agr. Engin., 4 (1923), No. 8, pp. 123, 124, figs. 2*).—In a contribution from the Iowa Experiment Station a dynamometer for testing horses is described and illustrated. This is based on the principle of having the horse pull against the resistance caused by a weight attached to a cable which passes over a pulley.

**Colony houses for swine, L. STEVENSON** (*Ontario Dept. Agr. Bul. 297 (1923), pp. 16, figs. 23*).—Drawings and bills of material for colony houses for swine and other hog yard fixtures are presented and discussed in this bulletin, particular reference being made to conditions in Ontario.

**Certain limitations of the *Bacillus coli* method in water examinations, V. G. RAJU** (*Jour. Hyg. [London], 21 (1922), No. 2, pp. 130-133*).—In a contribution from the Calcutta School of Tropical Medicine the results of bacteriological examinations of water supplies are briefly summarized, leading to the conclusion that, in testing for bacterial efficiency of sand filters, samples should be collected from the filter well and not from the clear water reservoir where water is usually stagnant for some hours. It is also concluded that, in interpreting the results of the examination of pipe waters, the possibility of an increase of *B. coli* having occurred through multiplication in the pipes should always be borne in mind before inferring that such increase indicates fecal contamination or leakage in the mains.

**Denitrification as a means of sewage purification, E. A. COOPER** (*Biochem. Jour., 15 (1921), No. 4, pp. 513-515*).—In a contribution from the University of Birmingham, experiments to determine to what extent nitrates can be reduced by the oxidizable constituents of sewage and to what extent the purification of sewage can be effected through the utilization of nitrates by the reducing microorganisms present in the sewage are reported.



The results showed that the dissolved oxygen absorption figures for the mixtures of tank liquors and nitrate solutions or filter effluents were very much lower than those for the corresponding mixture of tank liquor and water only. These results are taken to indicate that incubation of the sewage with nitrate solutions and filter effluents leads to the destruction of a considerable amount of oxidizable material present in the sewage. With concentrations of nitrate amounting to about 5 in 100,000, the degree of purification was enormous, while with lower concentrations the purification was still appreciable. The extent of destruction of the oxidizable matter was not necessarily proportional to the amount of nitrate present.

A comparison of the dissolved oxygen absorbed in 1, 3, and 5 days showed that the 1-day tests indicated a higher degree of purification through denitrification than the 3- and 5-day tests. From this it was concluded that the very readily fermentable matter is first attacked in the process of denitrification, and that the more resistant oxidizable matter is largely left and its presence indicated in the prolonged dissolved oxygen tests.

These results as a whole are taken to indicate the value of employing the nitrates produced in sewage filters for further sewage purification. It is thought that in practice considerable economy could be introduced into sewage purification by mixing part of the sedimentation tank liquor with the filter effluent, and thus employing the nitrate present for destruction of the more readily fermentable material. By this means a smaller filtering area would be sufficient to effect ample purification.

**Preliminary studies of the fauna of the Imhoff tank, L. A. HAUSMAN** (*Amer. Jour. Pub. Health*, 13 (1923), No. 8, pp. 656-658, figs. 4).—Studies conducted by the New Jersey Experiment Stations and the New Jersey State Department of Health on the fauna of Imhoff tanks are briefly reported.

Samples taken periodically over a term of six months are said to have shown that the Imhoff tank under study contains a relatively stable population composed of the more minute forms of protozoa. The samples examined were secured from the zones of the scum, intermediate liquid, and the sludge in process of digestion. The minute flagellates in dimensions of less than  $30\mu$  were the predominant forms of animal life found, and these fluctuated somewhat in numbers with respect to the acidity of the contents of the tank. The ciliate protozoa were found in fewer numbers and were relatively less stable in their monthly occurrence than the flagellates.

**The septic tank and tile sewage disposal system, H. H. MUSSELMAN and O. E. ROBEY** (*Michigan Sta. Spec. Bul.* 119 (1923), pp. 23, figs. 14).—A septic tank and tile sewage disposal system, which is the outgrowth of experience gained through the construction of nearly 100 systems and from observations on the operation of many of these under various conditions, extending over a period of eight years, is described. The system finally arrived at involves the use of four units and two distinct processes of bacterial action. The units are (1) an aerobic and settling chamber for the decomposition of solids in the sewage, (2) a siphon chamber, (3) a siphon, and (4) an aerating system of draintile for aerobic treatment of the sewage.

While it is thought that the processes undergone in this system may very greatly reduce the contaminating influence of the sewage, it is not assumed that freedom from such danger can be guaranteed. With this in view, it is stated that the sewers leading to and from the tank should be made watertight for a safe distance from the house and well, and that the aerating tile system especially should be so placed that it is not a source of danger. Specific information on the construction of sewage disposal systems of this



type is given, together with a sample bill of material. Drawings of a septic tank siphon developed at the station are given and discussed.

## RURAL ECONOMICS AND SOCIOLOGY.

**Standards of production in agriculture**, A. W. ASHBY (*Edinb. Rev.*, 235 (1922), No. 479, pp. 90-107).—Note is made of efforts to compare the productivity of the agriculture of Great Britain with that of other countries and of British agriculture as compared with other industries. The standards and methods used are held to have been of value only to economists or statesmen, and for purely farming purposes three methods of measuring the productivity of farm organization are suggested, the managerial income of the farmer and the return per unit of manual labor and horse labor. Records of five farms for the year 1918-19 are noted to indicate methods of evaluating production in terms of the use of land, labor, and capital.

**Investigations with reference to the returns from agriculture in Finland, 1912-13 to 1918-19**, J. E. SUNILA (*Landtbr. Styr. Meddel. [Finland]*, Nos. 100 (1915), pp. 200, figs. 19; 109 (1916), pp. 214, figs. 3; 118 (1918), pp. 207, fig. 1; 128 (1919), pp. 224, fig. 1; 133 (1920), pp. 212, fig. 1; 134 (1921), pp. 188, fig. 1; 141 (1922), pp. 129, fig. 1).—This investigation of financial returns from agriculture in Finland dates from the year 1912 when bookkeeping records from 122 farms, located mainly in the southern and central parts of the country, were analyzed and the returns tabulated and graphically presented. In 1913, 85; in 1914, 94; in 1915, 162; in 1916, 135; in 1917, 85; and in 1918, 84 records were tabulated.

**Farm costing and accounts**, C. S. ORWIN (*London: Benn Bros., Ltd.*, 1923, pp. 31).—Two kinds of bookkeeping on the farm are classified as financial accounts, which are relatively simple since they do not involve a knowledge of intricate bookkeeping processes, and cost accounts, which are designed to interpret costs of production and to supply information as to the economics of farm management. Both types of account keeping are discussed and illustrated.

**Nebraska farm tenancy.—Some community phases**, J. O. RANKIN (*Nebraska Sta. Bul.* 196 (1923), pp. 50, figs. 25).—Data previously noted (*E. S. R.*, 49, p. 189) are further analyzed from the point of view of community phases of land tenure, setting forth the growth of tenancy in Nebraska from 1880 to 1920; the distance to community activities; tenure changes from 1911 to 1920; shifts to and from the farms surveyed, 1911 to 1920; communication by means of the automobile, telephone, mail delivery, and country roads; churches, lodges, and farm organizations; and amusements. An extensive bibliography is included.

Nebraska farm tenancy is growing rapidly when measured by acreages, farm values, or number of farms, although two-fifths of the farms studied were not rented at all during the decade. Tenants shift from farm to farm about twice as often as do owners but a little less than twice as often as part owners. One-third of the farmers of all tenures have been on the same farms for more than 10 years. In eastern Nebraska three times as many farmers came to their present farms from within the community as from other communities. Church and Sunday school are reaching more farm people of all tenure groups than any other organization, except in one area peopled by those of Bohemian or Czechoslovakian descent.

About two-fifths of the men are members of farmers' organizations and a slightly smaller proportion are members of lodges, while more than one-fifth of the women are members of women's societies and a little less than a fifth



of them are members of lodges. Only 74 offices were held by the 1,141 farmers studied, and almost half of these were in farmers' organizations. Only about a sixth of all farmers report playing outdoor games, but three-fourths of the part owners, three-fifths of the owners, and less than half of the tenants have equipment for indoor games. Musical instruments of some kind are found in nearly three homes out of four.

**Intermediate credit for the farmer** (*U. S. Dept. Agr., 1923, pp. 5*).—Questions and answers on intermediate credit as provided by the Agricultural Credits Act of 1923 and essential facts showing the need for it are presented in this pamphlet.

**Rural credits in Utah**, E. B. BROSSARD (*Utah. Sta. Circ. 48 (1923), pp. 3-42, fig. 1*).—The author sets forth in detail the purpose and function of the Federal Farm Loan Board and the Federal land banks, the local national Federal farm loan associations, and the joint stock land banks making up the Federal farm loan system, and the Federal intermediate credit banks, national agricultural credit corporations, and national agricultural rediscount corporations, which constitute the newly established intermediate credit system. Bonds and debentures as investments is the subject of further discussion, and a critique is given of the Federal system of rural credits as a whole, in which it is assumed that when, as now contemplated and outlined in laws upon the statutes, it becomes actually operative and the minor legal and practical difficulties are overcome, the farmer's credit needs will be well taken care of. Appendixes contain the text of the laws of Utah of 1915 dealing with cooperative banks for personal credits, a list of national farm loan associations in Utah, and amortization tables.

**Agricultural credits and cooperative marketing in the United States**, B. M. ANDERSON (*Chase Econ. Bul., 3 (1923), No. 3, p. 35; also in Econ. World, n. ser., 26 (1923), Nos. 7, pp. 220-223; 8, pp. 260-262; 9, pp. 292-294*).—Agriculture is held to be an overexpanded industry in which new capital would intensify rather than alleviate the difficulties. Cooperative marketing is commended where it accomplishes technical improvements in the marketing process. It is said to have been especially needed in marketing perishable commodities but not so much so for those having highly competitive markets as do wheat and cotton. The holding of commodities for high prices is opposed, and the remedy for the farmer's difficulty is seen in the restoration of the balance among the world's industries through getting Europe back as a great producer and consumer which pays for foods and raw materials by sending a back flow of manufactured goods.

**The regulation of agricultural labor conditions in continental Europe**, H. M. CONACHER (*Internatl. Labor Off. [Geneva], Internatl. Labor Rev., 8 (1923), No. 2, pp. 173-190*).—The point is made that the nature of the existing systems of agriculture in Europe, together with the respective parts to be played in each by capital and labor, is determined partly by physical conditions favoring one type of production or another, partly by the demands of the consumer, and partly by historical forms of land tenure.

The three chief agricultural systems of Europe are described as that of the northern zone, including the countries of north and northwest Europe, especially those bordering on the North Sea, where the carrying on of agricultural operations is based on the work of the whole-time professional laborer; that of the south of Europe, including Spain, south Italy, and Sicily, where the system is capitalistic based mostly on large-scale landholding; and that of the region between northern and Mediterranean Europe, where peasant landholding and peasant agriculture predominate.



Reference is made to an inquiry by a Government commission into the economic position of the land worker in the Netherlands. This commission came to the principal conclusion that the protection of the worker on the land ought to be scientifically regulated, and dealt with the application to the land worker of various forms of insurance against sickness, accident, invalidism, and old age. The principal provisions of legislation with regard to agricultural labor must include the question of hours, the work of other than whole-time male laborers, and insurance problems.

It is held that while it may be possible to regulate hours of labor in connection with the more uniform systems of northern Europe, it is difficult to do so in north Italy and Hungary. To attempt to deal with the single problem of seasonal unemployment alone presents great difficulties. Schemes of insurance against agricultural unemployment in Europe do exist, but only in a few countries of northern Europe and not where they are most needed. The statutory regulation of hours of labor would seem to depend mainly on the question of whether a capitalized system of agriculture has given rise to a class of land workers who have succeeded in attaining some degree of organization among themselves. This is often wholly lacking just where it seems most required. Protection by insurance against accidents is apparently a benefit enjoyed most securely by agricultural workers in an industrialized country. The one device which may be said to be common to most European countries for the stabilizing or improving of agricultural labor conditions is land settlement.

**The Scottish farm worker**, J. WILSON (*World Agr.*, 2 (1922), No. 4, pp. 188, 189, fig. 1).—The wages and working hours of farm workers and the living conditions provided for them are noted briefly.

**The French farm worker**, G. RISLER (*Le Travailleur Agricole Français*. Paris: Payot, 1923. pp. 281).—This treatise is presented in two parts, the first covering the economic and social position of the farm laborer and the second measures for the protection of agricultural labor, including insurance, preventive hygiene, encouragement of ownership of small holdings, cooperation, and mutual aid.

**Compulsory accident insurance of agricultural workers in Italy** (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev.*, 16 (1923), No. 1, pp. 26-32).—By a decree of August 23, 1917, compulsory insurance of agricultural labor against accident was introduced into Italy. It covers all cases of accidents occurring in the course of employment if they result in death, permanent total disability, permanent partial disability reducing the working capacity by more than 10 per cent, and temporary total disability resulting in a loss of time of more than 10 but less than 90 days. The cost is borne entirely by the owner, the tenant by emphyteusis or the usufructuary of the land. The territory of the kingdom is divided into 35 districts, and in the chief town of each district a committee is appointed to fix the insurance rates. A single authorized institution in each insurance district is authorized to write agricultural accident insurance for all properties within the district.

Detailed statistics are available for eight months of the year 1919, and less detailed data for 1920 and 1921. From these it is noted that nearly one-fourth of all compensable accidents were due to the handling of tools, especially of cutting tools. Next in frequency occurred accidents caused by falls of injured persons, by transport apparatus, and by animals not attached to vehicles. The administrative expenses amounted in 1919 to 22.7 per cent, and in 1920 to 21.2 per cent of the total expenditures. This measure possesses essentially an experimental character, since it is provided that within five years of the date of



its coming into force a report on the results obtained shall be prepared, on the basis of which changes may be introduced.

**Regulations of the Secretary of Agriculture under the U. S. Warehouse Act of August 11, 1916, as amended.**—Revised regulations for cotton warehouses, approved May 29, 1923 (*U. S. Dept. Agr., Bur. Agr. Econ., Serv. and Regulat. Announcements* 76 (1923), pp. IV-35).—These regulations are amendatory of and intended to supersede the rules and regulations previously noted (*E. S. R.*, 48, p. 93). The text of the U. S. Warehouse Act as amended July 25, 1919, and February 23, 1923, is appended.

**Warehousing farm products under the U. S. Warehouse Act** (*U. S. Dept. Agr., 1923, pp. 12*).—This pamphlet contains questions and answers intended to make clear the provisions of the law of August 16, 1916 (*E. S. R.*, 35, p. 308), as subsequently amended (see above).

**Regulations of the Secretary of Agriculture under the U. S. Cotton Standards Act** (*U. S. Dept. Agr., Bur. Agr. Econ., Serv. and Regulat. Announcements* 80 (1923), p. IV+21).—Regulations under the act of March 4, 1923, are fixed and promulgated to be in force on and after August 1, 1923.

**Grain Futures Act, 1922** (*U. S. Dept. Agr., Misc. Circ. 10* (1923), pp. [2]+65).—General rules and regulations of the Secretary of Agriculture with respect to contract markets are presented here, as issued June 22, 1923. The text is given of the Grain Futures Act, September 21, 1922, and of the Future Trading Act of August 24, 1921, as well as of decisions of the U. S. Supreme Court bearing upon the constitutionality of these acts.

**Interim report on fruit and vegetables**, LINLITHGOW (*London: Min. Agr. and Fisheries, 1923, pp. 146, figs. 5*).—The departmental committee on distribution and prices of agricultural produce, appointed to inquire into the methods and costs of selling and distributing agricultural, horticultural, and dairy produce in Great Britain and to consider whether, and if so by what means, the disparity between the price received by the producer and that paid by the consumer can be diminished, submits an interim report based upon statistical data obtained from about 86 returns to questionnaires distributed. Recommendations are submitted with reference to the improvement of railway rates and facilities, the closer regulation of marketing costs and practices, the disposal of surplus produce, the standardization of packages, instruction with regard to grading and packing, and cooperation among producers.

It is suggested that earlier statistical information with regard to vegetables might be published during the planting season, and that the effective organization of the trade as a whole should be encouraged.

**The cattle crisis in Argentina**, G. B. L. ARNER (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 29* (1923), pp. 1+52, pls. 2).—This is a mimeographed report compiled from official and commercial sources, which sets forth the economic position of the cattle industry in Argentina, proposed measures for control, the development of new foreign markets, cattle prices in Buenos Aires and Chicago, the British market for Argentine beef, the profits of packing companies and the control of the Argentine packing industry, the cost of production of beef cattle in Argentina, cattle resources of the country, and export duties. Statistical tables in the appendixes show exports of frozen and chilled beef as well as of jerked beef, canned beef, and hides through periods of years.

**Hides and skins** (*U. S. Tariff Comm., Tariff Inform. Ser. No. 28* (1922), pp. III+28, fig. 1).—This report was prepared by F. A. Roper, M. A. Smith, L. G. Connor, and others. It is concerned with the supply of hides and skins and the relation of domestic production to consumption; the position of the large packers in the hide and leather industry; the relation between the price of



hides and of live cattle and the probable effect of a duty in benefiting the cattlemen; the tanning and leather industries, with special reference to the probable effect of a duty on hides and skins upon the price of leather products as well as upon the export trade therein; and compensatory duties.

**Cooperation in marketing poultry products**, T. A. BENSON (*Canada Dept. Agr., Live Stock Branch Bul. 25, n. ser. (1923), pp. 15*).—Details of organization for cooperative marketing, handling the commodity, and financing are set forth.

**Weather, Crops, and Markets** (*U. S. Dept. Agr., Weather, Crops, and Markets, 4 (1923), Nos. 18, pp. 457-480, figs. 3; 19, pp. 481-504, figs. 4; 20, pp. 505-544, figs. 2; 21, pp. 545-568, figs. 2*).—Tabulations and charts recording the temperature and precipitation in the United States during the weeks ended October 30 and November 6, 13, and 20, 1923, are given in these numbers, together with general and local summaries of weather conditions. The usual weekly and monthly reports on the receipts and prices and the position in the market of important classes of crops and livestock and of specific commodities are given in each number, together with estimates of production of different specific crops. The estimated crop conditions, November 1, 1923, with comparisons, the usual current farm price tables, and numerous summaries and crop reports appear in No. 20, as well as an article on the use of calcium arsenate on cotton plants noted on page 259. In No. 21 data are reported as to the percentage of infestation of wheat fields by garlic, cockle, and cheat in 1921 in Pennsylvania, Maryland, Virginia, Illinois, Missouri, Minnesota, North Dakota, South Dakota, and Montana.

**Farmers' Market Bulletin** (*North Carolina Sta. Farmers' Market Bul., 10 (1923), Nos. 65, pp. 12, figs. 2; 66, pp. 8*).—In the first of these two numbers, a brief note is presented with a chart illustrating the average price of live hogs by months in the year on the Chicago markets and discussing the best time for the producer to market his hogs. In the second, brief notes suggesting better marketing practices are given. Other notes and announcements are presented in both numbers, together with the usual list of products which farmers have for sale.

**Prices of Ohio farm products**, J. I. FALCONER (*Ohio Sta. Bul. 365 (1923), pp. 101-143, figs. 10*).—It is the purpose of this study to set forth some of the leading factors which have to do with price changes and relationships, principally those other than a general rise or fall in the price level. Changes in supply due to variation in crop yields and acreage and seasonal supply are noted, giving data for wheat, hogs, eggs, and market milk, which illustrate the close relation between seasonal supply and prices. Other factors and relationships that are briefly discussed are cost of production and price, the corn and hog ratio, the variation in the relative prices of farm products, price cycles, the effects of demand and quality upon price, the price of farm products and the price of land, and regional variations in prices. Sources of market information are briefly noted, and several tables of prices of Ohio farm products extending over a series of years are included.

**The standard of life in a typical section of diversified farming**, E. L. KIRKPATRICK (*New York Cornell Sta. Bul. 423 (1923), pp. 133, figs. 24*).—The study upon which this report, which was also submitted in partial fulfillment of the requirements for the degree of doctor of philosophy at Cornell University, is based was planned to determine in so far as possible the weights to be given to economic well-being, education of parents and children, use of leisure time, betterment of home surroundings, and participation in neighborhood and community activities in explaining the standard of life. The term as used here



indicates the sum total of values enjoyed by the family as evidenced through the acquisition and expenditure of income and through the use of time in the satisfaction of wants for things both material and spiritual.

Data were obtained by the survey method. The field work for the study of the farm business in the year ended March 31, 1919, was conducted by the department of agricultural economics and farm management at Cornell University. About 720 records of the farm business were taken on farms in Geneseo, York, Caledonia, Avon, and Lima townships, Livingston County, New York. The field work for the study of the business of the household for the year ended August 31, 1921, was carried on by the department of rural social organization at Cornell University, cooperating with the Bureau of Agricultural Economics and the Office of Home Economics of the U. S. Department of Agriculture. About 410 records were obtained from families that were living on the same farms in 1920-21 as in 1918-19. Of the 402 records finally used in the tabulation and analysis, 295 were from homes of owners and 107 of tenants. A scale of values for rating the homes with regard to standard of life was worked out from the opinions and suggestions received from approximately 100 replies of specialists and teachers in rural subjects, farm bureau and home demonstration leaders, editors of farm journals, farmers, and others, to whom a tentative scale had been submitted.

Some of the conclusions from the analysis of relationships are that the correlation between size of business, as measured by acres, capital, and work units, and the standard of life is about 0.4. The production of crops is less closely related than is size of business, and diversity, designated by percentage of receipts from crops in 1919, bears no relation to the standard of life in terms of total values. Mortgage and personal debt can not be held as lowering the standard of life, nor can farm tenancy be regarded as menacing it seriously. Living conditions in tenant homes compare very favorably with those in owner homes.

A few more than half of the families having high expenditures for all purposes have correspondingly high standards of life. Parents with relatively higher education are enjoying relatively higher standards, as well as using more capital or employing more labor; in fact, education is more closely related to total values than is number of acres. From the same standpoint and on a similar basis, education of children is more closely related to total values than is that of parents, and apparently the inclination to keep the children in school is a more significant index than is the tendency to cultivate more acres, to invest more capital, or to employ more labor.

The value and condition of the farmhouse bears practically the same relation to the standard of life as does capital or work units, that of the furniture, however, showing somewhat less relation than does the value of the house. The coefficients, 0.52 and 0.45, respectively, suggest that approximately half of the families giving the larger amounts for church support are enjoying relatively high standards of life, although apparently not more than one-third of the families high in church attendance are correspondingly high in total values. The number of papers and magazines taken bears about the same relation to the standard of life as do capital and work units. Although analyzed for only 50 farms ranking highest and lowest, respectively, in total values, the participation of members of the family as leaders in neighborhood and community activities, the expression of desire for neighborhood or community betterment, and appreciation of certain advantages in farm life, show a possibility of close relationship to the standard of life.



Tables are given showing the correlation between various factors. Blank forms used in collecting the data and a list of 118 publications bearing upon the question of the rural standard of living are included.

**Agricultural cooperation in the southern highlands of the United States,** O. D. CAMPBELL (*World Agr.*, 2 (1922), No. 4, pp. 190, 191, figs. 4).—A brief history is given of a general agricultural association organized among the hill farmers of a corner of Buncombe County, N. C.

**Danish agriculture and its cooperative system,** S. SÖRENSEN (*World Agr.*, 2 (1922), No. 4, pp. 180–183, 185, figs. 8).—The productivity of agriculture in Denmark and the development of the cooperative system are briefly set forth.

**Agriculture.—General report and analytical tables** (*Fourteenth Census U. S.*, 5 (1920), pp. 935, figs. 81).—This volume of the Fourteenth Census of the United States contains the general report and analytical tables of the census of agriculture arranged in chapters devoted to farms and farm property; size of farms; farm tenure; farm statistics by color and tenure of farmer; farm statistics by race, nativity, and sex of farmer; farm operators by age, number of years on farm, and farm experience; farm mortgages; selected farm expenses, cooperation, and farm facilities; livestock on farms and elsewhere; livestock products; summary for all crops; individual crops; forest products of farms, and nurseries and greenhouses; and farm population.

**Agricultural situation in Czechoslovakia,** L. G. MICHAEL (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 30* (1923), pp. 1+39).—This and the following are mimeographed reports covering an agricultural survey of Europe and especially of the Danube Basin. Statistics of production and exportable surplus of the principal agricultural products of the districts of Bohemia, Moravia, Silesia, Slovakia, and Ruthenia are summarized here.

The conclusions are reached that the depressed state of agriculture in Czechoslovakia is temporary, depending upon unstable economic conditions, that wheat consumption will probably increase because of the higher standard of living, and that the wheat deficit will be balanced by imports from the surplus-producing States to the south, rather than by drawing a considerable proportion of flour from the United States, as at present.

**Agricultural situation in the Republic of Hungary,** L. G. MICHAEL (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 31* (1923), pp. [5]+66).—This report consists of a statistical review of the pre-war balances of the districts of the Old Kingdom of Hungary, their pre-war foreign trade, and the present situation with respect to wheat, rye, corn, barley, oats, potatoes, sugar and fodder beets, and livestock. In the appendix is presented a report on the land reform in the Republic of Hungary, by D. A. Willson.

**Agriculture and livestock in Sweden, 1919 and 1920,** L. WIDELL ([*Sweden*] *K. Statist. Centralbyrå, Sveriges Off. Statist., Jordbr. och Boskapskötsel*, 1919, pp. VIII+147; 1920, pp. XI+261).—Statistics of agriculture, livestock, and wages are presented for the current years, continuing the series previously noted (*E. S. R.*, 44, p. 894). The volume for 1920 contains a summary of a statistical inquiry for the period 1913 to 1920, inclusive.

## AGRICULTURAL EDUCATION.

**Does mentality influence the choice of high school subjects?** J. H. HINDS (*Vocat. Ed. Mag.*, 2 (1923), No. 3, pp. 178–183).—In order to ascertain the influence of the mental level of the pupil upon the choice of concrete and abstract subjects, the Otis mental test was given to similar groups electing vocational and nonvocational subjects in a number of different schools in Texas. The vocational group was composed of students electing agriculture, home econom-



ics, and trades, while the nonvocational one was distributed among those choosing Latin, Spanish, French, physics, and mathematics.

The students electing vocational subjects had a median index of brightness 3.58 points lower than the median for a similar group of nonvocational students. The medians for agriculture, home economics, Latin, Spanish, and mathematics were, respectively, 93.33, 97, 104.06, 97.05, and 95.11. The results of other investigations which indicate the influence of parental occupation, nationality, race, and other influences are also noted in this connection. A brief list of references is given.

**The relationship between the vocational agricultural department of a high school and the high school as a whole**, J. L. HYPES (*Jour. Rural Ed.*, 3 (1923), No. 2, pp. 49-58, fig. 1).—The author takes into consideration the fundamental questions of the number of students who should be trained for farming, the definition of aims and content of vocational education in agriculture, and the differentiation and mutuality of aim which exist between vocational education in agricultural and nonvocational education. He concludes that effective vocational and educational guidance and an adequate vocational and general education for high school students who plan to farm necessitate such administrative and pedagogical provisions as are to be found in a general high school with a strong department of vocational agriculture. It is held that this department should be under the immediate administration and supervision of the local principal. It is not intended, however, to minimize the importance of State supervision.

**Bulletin of general information concerning vocational agriculture in Texas** (*Tex. State Bd. Vocat. Ed. Bul.* 154 (1923), pp. [1]+51, figs. 28).—This booklet offers information with regard to the equipment required in teaching vocational agriculture, outlines courses and part-time work, and makes suggestions as to the community activities which should be undertaken by the vocational teacher.

**Evening school work in vocational agriculture**, A. M. FIELD (*Vocat. Ed. Mag.*, 2 (1923), No. 2, pp. 97-103, figs. 2).—The importance of classes for farm workers in outlying communities, conducted by the teacher of vocational agriculture in the high school, is stressed, and suggestions are made as to job groups for study, methods of presentation, informal recitations, and teaching devices. It is urged that the class conduct a survey of farming practices in connection with the study of job groups, and a blank form for use in gathering the data is reproduced. At least six months of supervised practical work is recommended for recognized evening school work.

**Postgraduate training in agriculture at Pusa** (*Agr. Jour. India*, 18 (1923), No. 5, pp. 528-532).—A brief summary is presented of plans for the development of facilities for postgraduate courses in agriculture and the training of agricultural specialists at the Agricultural Research Institute and College at Pusa under the supervision of the Government of India.

**Graduate work in textiles and clothing**, K. T. CRANOR (*Jour. Home Econ.*, 16 (1924), No. 1, pp. 14-17).—It is urged that the field is broad for research in economic, social, historical, educational, artistic, chemical, and hygienic problems associated with textiles and clothing.

**A training school for home makers**, C. E. REED (*Vocat. Ed. Mag.*, 2 (1923), Nos. 2, pp. 119-123, figs. 4; 3, pp. 209-213, figs. 2).—A continuation school for girls employed in the mills of Fall River, Mass., is described.

**Consolidation of schools and transportation of pupils**, J. F. ABEL (*U. S. Bur. Ed. Bul.* 41 (1923), pp. IV+135, pls. 13, figs. 25).—The different forms of school consolidation in general but more particularly as it applies to rural

schools, the laws governing it, its history and development, the measures of its progress and success, and its advantages are dealt with here. The three chapters cover, respectively, the history and development of consolidation and transportation, its present status, and a statement of the extent of it by States.

**Statistical method in agriculture**, F. W. GIST (*Montgomery: Ala. Dept. Ed.*, 1923, pp. 80, figs. 10).—This is the collected lectures given by the author to pupils enrolled in classes in vocational agriculture in the rural high schools of Alabama and to a class in rural economics at the Alabama Polytechnic Institute. It is intended to serve as a guide to teachers of vocational agriculture, presenting the subject of statistical methods.

**Agriculture for the Kansas common schools**, L. E. CALL and H. L. KENT (*Topeka, Kans.: State*, 1923, 2. ed., rewritten, pp. 480, pls. 8, figs. 257).—A textbook previously noted (*E. S. R.*, 33, p. 494) has been revised and rearranged.

**Food planning and preparation**, M. T. WELLMAN (*Philadelphia and London: J. B. Lippincott Co.*, 1923, pp. XX+334, pl. 1, figs. 113).—A junior course in food study is presented in 14 chapters, suggesting class work in connection with breakfasts, school lunches, weight and food selection, luncheons and left overs, dinners and the preparation of meats, bread, sweets, economy in purchasing food, baby feeding, sick diet and other special menus, canning, and equipment for food preparation. No attempt is made to divide the material into lessons, due to the recognized necessity for varying the length of them according to circumstances. Numerous recipes are given.

**Healthful school lunches**, S. J. MATHEWS (*Ga. Agr. Col. Bul.* 274 (1923), pp. 27, figs. 5).—Menus and recipes and the most acceptable ways of packing and serving cold lunches are discussed, and suggestions are made with reference to the preparation of hot lunches at school.

**Health of the family.**—A program for the study of personal, home, and community health problems (*Fed. Bd. Vocat. Ed. Bul.* 86 (1923), pp. VIII+303).—This bulletin is designed for use in evening classes in home economics and attempts to point out means and methods for preventing illness in the home, applying simple first aid remedies, and giving strict attention to directions from the attending physician. The teaching material is presented in six units dealing, respectively, with community health and the home, the home and the health of the family, the personal health of the family, illness in the home, diseases, and first aid and emergencies. The manuscript was prepared by F. B. Sherbon and edited by A. R. Van Meter.

**Boys' and girls' clubs**, F. W. JENKINS (*Bul. Russell Sage Found. Libr.*, No. 60 (1923), pp. 4).—This is a selected and annotated bibliography of 72 titles. A number of organizations publishing reports and manuals of interest to club leaders are listed.



## NOTES.

---

**Kansas College.**—A farm business short course was offered from February 11 to 29, following Farm and Home Week. The work was divided into six subjects, farm accounts, farm marketing, farm management, farm taxation and other land problems, farm credit, and farm life.

**American Society for Horticultural Science.**—The twentieth annual meeting of the American Society for Horticultural Science, held at Cincinnati, December 27-29, 1923, was characterized by an unusual number of valuable papers and by a very satisfactory attendance at all sessions.

The most notable paper, as indicated by the amount and earnestness of the subsequent discussion, was that delivered by J. C. Blair in which was presented an earnest appeal for a nation-wide conference of horticultural teachers and investigators for the purpose of improving and coordinating methods of teaching and research. Emphasizing the fact that research knows no geographical boundaries such as State lines, he urged the need of closer contact between institutions, particularly those located in similar agricultural areas. It was finally decided to devote at least one-half of a day of the 1924 Washington meeting to papers relating to the proposed conference.

The address of the retiring president, J. H. Gourley, upon horticultural development during the past 75 years clearly depicted the various steps which have culminated in the productive period of research of the present time. A. J. Heinicke, in discussing the effect of nitrogen applications and of ringing upon the set of apples, reported that early spring applications of nitrates do not increase the set of fruit in all apple varieties, and expressed the belief that the range of carbohydrate nitrogen ratio which allows satisfactory fruit setting is wide. Studies of the oxidase activity in stored apples, reported by B. D. Drain, indicated that in many varieties oxidase activity is confined to certain parts of the fruit. F. S. Howlett reported that the nitrogen and carbohydrate contents of apple fruits sticking to the tree subsequent to pollination is considerably higher than that of abscissing fruits.

The growth response of apple shoots to ringing and defoliation was discussed by E. M. Harvey, who stated that, while ringing and defoliation together always retard the growth of shoots, ringing alone at certain seasons has little or no deleterious effect. In general, the results of ringing were the reverse of those produced by defoliation. J. H. Gourley presented details of a novel experiment, in which, by means of inserted tubes, nitrate of soda solution was supplied to the trunk of sod grown trees. As a result, the leaves of the treated trees took on a rich green color and bloomed abundantly the succeeding year, suggesting that the lack of nitrogen rather than a toxic condition in the soil is the cause of poor growth.

S. H. Cameron reported upon microchemical studies with apricot and pear wood, in which he found that the bulk of starch is stored in the medullary rays in the apricot, while in the pear it is found in both the pith and the rays. Grape breeding studies at the Maryland Station, as reported by E. C. Auchter and W. E. Whitehouse, indicated that very few promising seedlings are pro-

duced as a result of open pollinations. A. L. Schrader, of the same station, reported that a definite relation was found in grape pruning studies between vigor of growth and productivity, the maximum production occurring in canes of medium vegetative tendencies. Auchter and Schrader, in discussing fruit spur growth and fruit bud production in the apple, pointed out the inadvisability of drawing too hasty and general conclusions from preliminary investigations. They found that in middle aged trees as high as 40 per cent of the spurs may be permanently nonblooming, and that in the crop year all spurs on biennially fruiting apple trees may bloom, irrespective of length. A. J. Farley reported that peaches may be profitably thinned over a relatively long period.

L. G. Schermerhorn found that the shape of sweet potatoes was decidedly affected by fertilizers, the absence of potash resulting in an elongation of the roots. R. Magruder reported that limestone used alone had a favorable influence on all vegetables, but that when used in connection with chemicals it may have a deleterious effect on cucumbers and tomatoes. J. Bushnell, reporting upon the effect of temperature on potato plants stated that increased respiration at high temperatures, resulting in the loss of carbohydrates, is the factor responsible for the failure of potato plants to form tubers under such conditions. In dormancy studies with the onion, V. R. Boswell was unable to stimulate renewed growth activities by the action of freezing or of etherization. H. W. Schneck emphasized the need of artificial pollination of greenhouse tomatoes and discussed various practices. W. E. Loomis reported as to the effect of hardening on transpiration and root replacement, stating that hardened plants transpired much more rapidly than do tender plants. The value of statistical records for determining the constancy of tomato strains was emphasized by H. D. Brown. H. C. Thompson reported that the time of planting was the sole important factor concerned in the premature seeding of celery.

The importance of using seedlings of large size and good vigor in the propagation of the apple was urged by K. Sax. A. F. Vierheller found that heat, light, moisture, temperature, and wounding and girdling of parent branch had no appreciable effects on the rooting of apple cuttings. J. S. Bailey reported the finding of protoplasmic connections between the cells of all living tissue of the apple tree.

W. C. Dutton and H. M. Wells stated that Bordeaux mixture reduced the size of Montmorency and Morello cherries and increased transpiration in the cut shoots of the cherry. C. C. Starring, reporting upon work at the University of California on the influence of carbohydrate and nitrogen content on root production in tomato cuttings, stated that roots were formed abundantly under conditions of high carbohydrates and low nitrogen. C. H. Connors found that the color of hydrangea flowers could be effectively controlled by the regulation of the lime content of the soil. I. C. Hoffman reported that thermoelectric tests with purple and green potato sprouts showed a much higher temperature in the dark colored sprouts, and suggested a possible relation between tipburn and color.

A joint session held with the American Phytopathological Society and the Horticultural Inspection Service of the American Association of Entomologists brought out some interesting discussions concerning the actual harmfulness of crown galls on nursery stocks.

Dr. M. J. Dorsey, of the West Virginia Station, was elected president and C. P. Close, of the U. S. Department of Agriculture, secretary for the ensuing year.



# EXPERIMENT STATION RECORD.

VOL. 50.

MARCH, 1924.

No. 4.

The attitude of the various nations which participated in the World War toward the support of agricultural research since the termination of the conflict is a matter well worthy of study. This is particularly true because agriculture was credited with such a vital part in successful resistance, and its response to the extraordinary demand put upon it was so largely attributable to the results of research. No comprehensive survey seems to have been attempted, as yet, and in many cases the data at hand are too incomplete for detailed discussion. For Great Britain, Canada, and France, however, considerable information has become available.

In their agricultural policies all of the combatant countries seem to have been confronted with conflicting desires in greater or lesser degree. On the one hand, the war has furnished a concrete and convincing demonstration of the intrinsic value of agricultural research to a nation and tended toward its perpetuation on an adequate and permanent basis. On the other hand, the stupendous financial outlays and economic waste of the struggle have given strong impetus to the curtailment of expenditures in every direction. The resultant action from these opposing forces has varied widely in the different countries.

Extended discussion was given in these columns last June of some of the developments in Great Britain. The outstanding event has been the repeal in 1921 of the war-time legislation known as the Corn Production Act. This repeal discontinued the direct Government subsidies for grain production, but it also contained new legislation, one feature of which was the making of an appropriation of £1,000,000 to the Development Fund, of which £850,000 was available for use in England and Wales and the remainder in Scotland. This fund is the chief source of financial support by the British Government to agricultural education and research. Originally instituted in 1909, it has been largely instrumental in the upbuilding of a definite system of agricultural research and demonstration.

Information recently made public indicates that fully one-half of the fund last provided has now been allocated for agricultural research and advisory work in England and Wales. Of this amount,

£76,200 has been allotted for capital expenditures for general research and £114,350 for maintenance. In addition, £150,000 has been assigned to research in animal diseases, £42,400 to the work of the National Poultry Institute, £49,350 to advisory work, and £64,700 to special grants and miscellaneous enterprises.

For many of the research institutes the grant from this fund represents a very large proportion of their total resources, while others receive considerable contributions from outside sources. In general, however, the net result has been a marked expansion. For the fourteen research institutes in England, there has come about an increase in funds from about £19,000 per annum before the war and £77,000 at its close to about £127,000. For certain centers the development has been particularly striking. Thus, for the well-known work of Rothamsted, the grants have risen from £5,000 to £24,400. At Cambridge University, where the research institute has specialized in plant breeding and animal nutrition, there has been an increase from £5,350 to £26,200, and at Oxford University, stressing agricultural economics, from £800 to £10,500. Fruit growing at Bristol University and dairying at the University of Reading have been similarly fostered, with respective increases of from £3,600 to £18,900 and £2,200 to £11,700.

It is reported that still further increases are quite probable in the near future for some of these institutions. Within the past few weeks announcement has been made of the acceptance by Oxford University of grants for an institute in agricultural engineering.

This continuance and extension of Government aid is regarded by the Development Commissioners themselves as very significant of the increased appreciation of agricultural research in Great Britain. As stated by them in a report previously quoted in these columns, "the new grant for agricultural education and research is indeed a noteworthy illustration of the change that has taken place in the outlook of farmers' leaders. The change has, of course, been accelerated by the experiences of war, but it must be ascribed primarily to the progress already made by those engaged in agricultural education and research. If farmers had not seen for themselves the improvements that have been effected, and further, if they had not recognized the possibilities of development by enlisting for their industry the services of scientific men, there would have been no payment of £850,000 into the fund; and in the present financial condition of the country, curtailment, rather than extension of agricultural education and research, must have been faced in the immediate future."

In the case of Canada it must be observed that the postwar developments are much less encouraging. In the Dominion, Federal



aid to the provinces for fostering agriculture was initiated in 1913 with the passage of the Agricultural Instruction Act, which appropriated a total of \$10,000,000 to the various provinces for a ten-year period. This period terminated March 31, 1923, and provision was made by Parliament for the continuance of the appropriation only on a considerably reduced basis and for a single year. Despite efforts for its extension, it is reported that official notice has recently been given to the provincial ministers of agriculture by the Dominion Prime Minister that no further financial assistance is to be expected. This decision, it is understood, has been reached in an endeavor to obtain an approximate balance between the Dominion revenues and expenditures. Its practical effect is to throw upon the provinces the entire financial burden of agricultural instruction. According to a recent issue of *Scientific Agriculture*, the official organ of the Canadian Society of Technical Agriculturists, it is thought that in Ontario and Quebec existing projects will be substantially continued from provincial funds. For the remaining provinces, however, a serious curtailment of activities is deemed well-nigh inevitable.

The great bulk of the disbursements under the act have been for purposes of instruction rather than for research, but the withdrawal of funds can hardly fail to retard experimental work in progress or in contemplation. A statement from the society in advocacy of the grant points out that a great deal of the work on behalf of agriculture in Canada thus far has been of an elementary character, but maintains that "the time has come in agriculture as it has in other industries when deeper and more difficult problems must be dealt with. Research of a high order is therefore imperative. In the various provinces, facilities, a number of which have been provided through the Federal assistance, are available and men with advanced training are becoming numerous. Money is all that is required to put them to work on problems which, while they may be centered in provinces, are of national importance. Canada is wonderfully equipped with agricultural institutions, institutions that are staffed with highly trained men but institutions that, one and all, are starving for financial assistance to do research work. Research work for the country as a whole can not be confined to one department or one laboratory, nor can teaching institutions live without it. Research work was not specified in the act proving the grant, but institutions are now ready for it; problems of all kinds are pressing for solution, and men must be trained to deal with them."

Apparently there is no disposition to diminish the appropriations of the Dominion Department of Agriculture, and there is the possibility of increased provision through this agency although there are no indications of such a development. In any case, however,

the Canadian society foresees increased difficulty in providing an adequate supply of trained men for the department's work unless the resources of the colleges are at least maintained at their present levels. This factor adds appreciably to the ultimate seriousness of the situation.

Notice has also been received of the suspension of the publication of the *Agricultural Gazette of Canada* with the current March-April issue. This journal has been published by the Dominion Department of Agriculture as its official organ, and it was in the midst of its eleventh volume. While not utilized primarily as a medium for the publication of the department's research work, it has contained many official announcements, useful summaries of the various educational, experimental, and extension activities, news notes, and other data. Its nonappearance will materially increase the difficulty of keeping in touch with happenings in the Canadian field.

In France, notwithstanding the heavy financial burdens from the war, governmental policy seems to be shaping itself very definitely toward increasing activity in agricultural research. This is the result of a movement in progress for several years. In 1918 a notable paper was presented to the French Academy of Sciences by M. Tisserand, honorary director of agriculture, in which the need of comprehensive experimentation was set forth. He drew attention to the fact that "the countries which have made the greatest progress in agriculture and which obtain the greatest riches and most abundant harvests are those which have fostered on the most generous basis the institutions of research and instruction of the highest grade, and developed in all the rural classes a desire for experimentation and confidence in the discoveries of investigators, as well as in the efficiency of their application." In conclusion he declared that the road to follow was clearly indicated, as embracing "a service of stations and laboratories for scientific research and a service of popularization and teaching to guide agriculture in the path of progress."

Early in 1919, a law was enacted by the Government establishing departmental and regional offices of agriculture with a view to stimulating agricultural production and rehabilitation through demonstrations and other extension methods. These offices, it is reported, speedily found themselves confronted by a multitude of complex problems, solution for which could only be expected from patient scientific study in the laboratory. As one account puts it, "without a well-organized service of stations and laboratories, where chemists, physicists, and other experts in natural science could study these problems and thus methodically work out the future needs of agriculture, the agricultural offices would some day find themselves reduced to a kind of empiricism and their efforts blasted by sterility."



Largely in consequence of this situation, the Ministers of Agriculture and Finance were instructed to work out a comprehensive research system, and in 1920 these officials submitted to the President of France a joint report. This report embraced an elaborate project completely reorganizing the existing facilities. Briefly stated, it included the establishment of a large central station at Versailles-Trianon for research in agronomy, phytogenetics, plant pathology and entomology, and agricultural ornithology at an estimated cost of 1,600,000 francs; a station in Paris for the study of animal and human nutrition to cost 125,000 francs; a series of regional stations for agronomy, pomology, zootechny, and dairying to cost collectively 950,000 francs; the reorganization of sixty-eight of the seventy-five existing stations and laboratories at a cost of 700,000 francs; and the provision of a central library and publication service to cost 100,000 francs.

The total initial cost to the Federal Treasury was thus estimated at 3,475,000 francs, and the annual cost of maintenance at 4,000,000 francs as compared with the actual expenditure at that time of 1,385,000 francs per annum. Provision was also contemplated for the administration of this new system by a central office of scientific research as applied to agriculture, located within the Department of Agriculture and in charge of a director assisted by an administrative council.

This plan seems never to have been acted upon in its entirety, but early in 1921 an appropriation of 2,000,000 francs was made for experimental work, and the establishment was authorized of an Institute of Agricultural Research as an office of the Ministry of Agriculture. A subsequent presidential decree prescribed the organization and functions of this institute.

Under this decree, the institute was charged with developing scientific research applied to agriculture with a view to stimulating increased production. To this end the existing laboratories and stations hitherto administered by the department were transferred to its jurisdiction, and within the limits imposed by the appropriations it was empowered to establish new stations and laboratories, grant subsidies to either public or private institutions for agricultural investigation, and otherwise assist scientific workers to devote themselves to this field of inquiry.

The administration of the institute was intrusted, under the general supervision of the Minister of Agriculture, to a director and a council of administration of twenty-eight members. Of these members six are selected by the Academy of Sciences, a like number by the Academy of Agriculture, and the remainder by the Minister of Agriculture, three being members of Parliament, three persons noteworthy in agriculture or science, three representatives of agricultural

associations, and one a nominee of the Minister of Finance. The council must meet at least semiannually and exercises advisory functions over fiscal matters, the opening, transfer, or discontinuance of laboratories or stations, and over such questions pertaining to work and personnel as may be submitted to it by either the Minister of Agriculture or the director of the institute.

The initial report of the institute covering the calendar year 1922 has only recently become available. This report announces the personnel of the council as headed by M. Tisserand as president; Senator de St. Quentin and Dr. Roux, the director of the institute, as vice presidents; and M. Bruno, inspector general of the agricultural stations and laboratories, as secretary; and with a membership which contains many of the best known names in French agricultural science. Its subdivision into commissions of soils, plants, hygiene and nutrition, mechanics and agricultural physics, and finances is described, as well as the fact that the commission on agricultural physics has secured the services of several additional members, among whom are Mme. Curie and M. Daniel Berthelot.

The institute has had under its jurisdiction eighty-eight stations and laboratories, of which thirty are merely recipients of grants. Most of these institutions are specialized, twenty-eight dealing with agronomy, eight with enology and viticultural research, four with agronomy and enology, twelve with entomology and phytopathology, nine each with physics and agricultural information and special laboratories of various kinds, four with vegetable biology, three with studies of resins, two each with microbiology, sericulture, zootechny, the nutrition of man and animals, and mechanics, and one each with pomology, agrotechny, phytogenetics and seed testing, and animal diseases. The total personnel of these stations was 236, of whom 134 were directors and heads of departments.

Partly to provide a medium for the publication of the station research, the institute has taken over as its official organ the *Annales de la Science Agronomique Française et Étrangère*. This journal, it will be recalled, was established in 1884 by M. Louis Grandeaue, and for some time has been published under the auspices of the Ministry of Agriculture and the Alumni Association of the National Institute of Agriculture. The institute is also continuing the publication of the *Annales de Épiphyties*.

Considerable attention has also been given to the development of a central research library. This is evidently to be conducted in the interests of the station group as a whole and is expected to function in various ways as a central clearing house of information.

A conservative policy has been pursued as regards the opening of new research stations in France, but on October 15, 1923, a decree



was issued looking toward the establishing of a central station and a series of regional stations for the improvement of cultivated plants. Under this decree the central station is charged with the building up of as complete collections as possible of improved varieties of both domestic and foreign cultivated plants, the assembling of all available information on phyto-genetics, and with the assistance of the regional stations the active prosecution of research in plant breeding and related lines. The regional stations are also empowered to carry on, independently of the main program, tests of old and new varieties with special reference to local conditions and needs.

Some weeks later a similar decree was issued authorizing eight additional central stations, with regional stations in each case. These stations would deal, respectively, with agronomy and soil biology, physics and agricultural meteorology, microbiology, entomology and agricultural parasitology, phytopathology and vegetable parasitology, zootechny, nutrition research, and the prevention of animal diseases. It is expected that a number of these stations will be grouped as a research center at Versailles, where a tract of about seventy-five acres has been acquired in the famous park through the cooperation of the Bureau of Waters and Forests. It is thought probable that groups will be located at Ville Nave-d'Ornon in the suburbs of Bordeaux and at Clermont-Ferrand in the Department of Puy-de-Dôme.

It is thus apparent that the foundations are being laid for a comprehensive system of agricultural research in France, utilizing the existing structure as far as possible but supplementing it by more adequate provision for fundamental investigations. One of the serious handicaps of the French system in the past has been the meager financial resources of most of the stations, limiting them quite closely to the simpler forms of experimentation. The central stations now contemplated are evidently intended to rectify this weakness, and their authorization constitutes a direct recognition of the value of relatively large scale and generously supported research institutions.

The success of the new movement will evidently depend quite largely upon the permanence and extent of this support, and their development will be observed with great interest. The beginning of the reorganization at a time of financial stress like the present, however, is at once a tribute to the farsightedness of the French Government and a hopeful augury for their uninterrupted and successful development.

## RECENT WORK IN AGRICULTURAL SCIENCE.

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

**Textile chemistry**, F. J. COOPER (*London: Methuen & Co., Ltd., 1923, pp. IX+235, figs. 240*).—This volume is designed to furnish the prospective textile worker the necessary background of chemical knowledge of the materials used in the technical processes of the textile industry. The first 12 chapters constitute an elementary laboratory manual of inorganic chemistry, with a chapter on carbon compounds such as is usually included in such a course. This is followed by 6 chapters on the application of chemistry to textiles, dealing, respectively, with the natural fibers, the machinery, sizing, bleaching, dyeing, and mercerizing.

**Perfumes and cosmetics, with special reference to synthetics**, W. A. POUCHER (*London: Chapman & Hall, Ltd., 1923, pp. XI+462, pls. 47, figs. 5*).—This volume includes a dictionary of the more important raw materials used in the manufacture of perfumes, details of the preparation of numerous natural and synthetic perfumes, and formulas for various cosmetics.

**On glutathione.—IV, Constitution**, J. H. QUASTEL, C. P. STEWART, and H. E. TUNNICLIFFE (*Biochem. Jour., 17 (1923), No. 4-5, pp. 586-592*).—Analytical evidence is presented that in glutathione, previously shown by Hopkins to be a dipeptid of glutaminic acid and cystein (E. S. R., 46, p. 110), the linkage takes place between the H of the  $\text{NH}_2$  of cystein and the OH of the  $\text{COOH}$  group of the glutaminic acid not attached to the  $\text{NH}_2$  group, and that consequently glutathione is itself an  $\alpha$ -amino acid. It is pointed out that until glutathione is synthesized these conclusions can not be considered final.

**The preparation of creatinin from creatin**, G. EDGAR and W. S. HINEGARDNER (*Jour. Biol. Chem., 56 (1923), No. 3, pp. 881-886*).—The method described consists essentially in converting creatin into creatinin hydrochlorid by treatment with hydrochloric acid and setting free the creatinin by treatment with ammonium hydroxid. The technique is described for the conversion of creatin into creatinin hydrochlorid by treatment with gaseous HCl at room temperature, or into creatinin hydrochlorid solution by treatment with hydrochloric acid on a steam bath, and for several methods of converting the hydrochlorid into free creatinin. The yield of creatinin depends upon the combination of methods selected, from 83 to 90 per cent of the theoretical yield being possible. The purity of the substance depends partly upon the method and partly upon the purity of the original creatin. The most satisfactory method for the final purification of the creatinin consists in dissolving 1 part by weight of creatinin in 5 parts of water previously heated to  $65^\circ \text{C}$ ., adding 2 volumes of acetone, and cooling the mixture on ice. After standing a few hours the creatinin is filtered off, washed with acetone, and dried.

**The composition of cashew nut oil**, A. P. WEST and C. C. CRUZ (*Philippine Jour. Sci., 23 (1923), No. 4, pp. 337-344*).—Data are given on the composition of the oil and the press cake obtained from the cashew nut, the seed of *Anacardium occidentale*, a small tree extensively cultivated in the Philippines. This tree



has a large, yellow, pear-shaped fruit with a kidney-shaped seed. The fruit is eaten raw and the kernel either raw or roasted. The oil obtained from the pressed kernels has a sweetish taste and yellow color and is used for edible purposes.

The composition of the oil cake is given as follows: Oil 16.12 per cent, moisture 2.37, ash 3.94, protein 31.67, nitrogen 5.7, crude fiber 0.44, and carbohydrates 45.46 per cent.

The constants of the cashew nut oil are specific gravity  $26.6^{\circ}/4^{\circ}$  0.9105, refractive index at  $30^{\circ}$  C. 1.4665, iodine value (Hübl) 85.20, saponification value 187.00, acid value 1.45, and unsaponifiable matter (per cent) 1.47. The oil consists of 80.4 per cent of olein, 17.3 per cent of stearin, and 1.5 per cent of unsaponifiable matter.

**The composition of pili nut oil**, A. P. WEST and S. BALCE (*Philippine Jour. Sci.*, 23 (1923), No. 3, pp. 269–276).—Analyses are reported of the cold-pressed oil of the pili nut obtained from the seeds of *Canarium ovatum*. This oil is light yellow in color, of an agreeable odor and taste, and suitable for culinary purposes. The nuts themselves, when roasted, are said to have a delicious flavor and are considered by many to be superior to almonds.

The constants of the oil are given as follows: Specific gravity  $30^{\circ}/4^{\circ}$  0.9069, refractive index at  $30^{\circ}$  C. 1.4646, iodine value (Hübl) 55.9, saponification value 197.4, acid value 1.42, and unsaponifiable matter (per cent) 0.19. As the result of the separation of the oil into saturated and unsaturated acids and the examination of both fractions, the composition of the oil is given as olein 59.6, palmitin 38.2, stearin 1.8, and unsaponifiable matter 0.2 per cent.

**Effect of composition on the complete hydrogenation of some Philippine oils with nickel catalyst**, A. P. WEST and L. GONZAGA (*Philippine Jour. Sci.*, 23 (1923), No. 3, pp. 277–293, pl. 1, figs. 3).—A simple laboratory apparatus for the catalytic hydrogenation of oils is described and illustrated by diagrams and photographs. The preparation of a nickel catalyst and the use of the apparatus for laboratory hydrogenation of oils are described in detail. Data are presented on the constants obtained in the hydrogenation of various Philippine oils with 0.5, 1, and 3 per cent of nickel for varying periods of time.

These data show, in general, that for a definite period of absorption an increase in the concentration of nickel gave a decrease in the iodine value and an increase in the melting point of the oil. Lumbang oil was reduced to a hard solid with an iodine value of 1.08 and a melting point of  $67.5$  to  $71.5^{\circ}$  C. Pili nut oil when hydrogenated had an iodine value of 0.76 and a melting point of  $66$  to  $66.8^{\circ}$ . Coconut oil when completely hydrogenated had a melting point of  $32$  to  $43^{\circ}$  and no iodine value. Palomaria oil was not reduced to a hard solid fat of high melting point. This is thought to be due to the high acidity of the oil.

**The isolation from cabbage leaves of a carbohydrate, hitherto undescribed, containing three carbon atoms**, H. W. BUSTON and S. B. SCHRYVER (*Biochem. Jour.*, 17 (1923), No. 4–5, pp. 470–472).—The authors report the isolation from cabbage leaves of a 3-carbon sugar of the empirical formula  $C_3H_6O_4$  and a constitutional formula  $CH_2OH.CHOH.O.CH_2OH$ . This formula suggests the possibility of the synthesis of the compound in the plant by the condensation of formaldehyde and glycollic aldehyde.

The carbohydrate is obtained from the liquid remaining after the treatment of the cabbage leaves by the technique described by the authors (E. S. R., 46, p. 802) and by Chibnall and Schryver (E. S. R., 47, p. 109). The liquid remaining after treatment with barium hydroxid and carbon dioxid in the presence of alcohol is treated with sulphuric acid to remove barium quantitatively,



evaporated to a sirup, and the sirup left standing under three times its weight of 90 per cent alcohol for 2 or 3 days. The impure crystals thus obtained are treated in a Soxhlet apparatus for 6 hours with absolute alcohol and are then boiled with glacial acetic acid and filtered hot. The purified substance crystallizes in needles melting at 148° C. These are soluble in cold water and in hot glacial acetic acid, but insoluble in most other organic solvents.

**Pectin and its hypothetical precursor, "protopectin,"** F. TUTIN (*Biochem. Jour.*, 17 (1923), No. 4-5, pp. 510-514).—Attention is called to the generally accepted theory that unripe fruits contain an insoluble compound, the protopectin of Fellenberg (*E. S. R.*, 40, p. 202), which on hydrolysis during the process of ripening or when heated with acids becomes soluble pectin. As an alternative explanation of the fact that it is impossible to obtain as much soluble pectin from unripe as from ripe fruits, the author suggests that "no such substance as 'protopectin' exists, but that the persistent retention of pectin in an apparently insoluble form by the tissue of incompletely ripe fruits is due partly to the presence of substances insoluble in water but soluble in alcohol, but more particularly to the great difficulty in attaining, by mechanical means, really efficient disintegration of the unripe tissue."

In support of this theory, data are presented on the amount of pectin recovered by extraction with distilled water from the alcohol-extracted dried tissue of unripe apples after grinding in a mortar, regrinding twice with sand, and autoclaving with hydrochloric acid. From 8.8 gm. of dry tissue, the amount of pectin obtained by these successive treatments was 1.9347, 1.5104, 0.3238, and 0.1005 gm, respectively. The fact that nearly as much pectin was obtained after the second, more efficient grinding as after the first is thought to prove conclusively that all the pectin occurs in the soluble form. "The problem of estimating pectin in fruits, therefore, appears to resolve itself, in the first instance, into one of attaining complete disintegration of the tissue."

**The hemicelluloses, I-III** (*Biochem. Jour.*, 17 (1923), No. 4-5, pp. 493-509).—Three papers are presented.

I. *The hemicellulose of wheat flour*, D. H. F. Clayson and S. B. Schryver (pp. 493-496).—A hemicellulose has been isolated from wheat flour by successive extractions of the gliadin by 70 per cent alcohol, the starch by three digestions with taka diastase, and the glutenin by repeated extraction with dilute alkali. The mass remaining after these extractions is treated with cold 4 per cent sodium hydroxid which dissolves the hemicellulose, leaving undissolved cellulose and a small amount of cytopectic acid. These are removed by filtration through a thick pad of paper pulp made up with 4 per cent sodium hydroxid. On acidifying the filtrate with acetic acid, the hemicellulose separates out as a bulky white precipitate which is filtered, washed with cold water and graded strengths of alcohol and ether, and finally air-dried.

As thus obtained, the flour hemicellulose is a light white powder which dissolves readily in boiling water from which it separates in an amorphous form on cooling. It is soluble in *N* NaOH, from which it can be precipitated by acids.

The quantitative estimation of hemicellulose in two samples of flour of known origin, one a "straight run" flour corresponding to a yield of 73 per cent of the wheat and the other a more refined flour corresponding to a 23 per cent yield, gave yields of hemicellulose of 5.4 and 3.6 per cent, respectively. It is suggested that the hemicellulose in flour may be a factor in the value of the flour for breadmaking.

II. *The hemicellulose content of starches*, S. B. Schryver and E. M. Thomas (pp. 497-500).—The hemicellulose content of various commercial starches has



been determined by the method outlined in the previous paper, with the following yields of crude hemicellulose: Sago 4.1, maize 3.9, tapioca 2, wheat 1.65, and rice 1.2 per cent. Practically no hemicellulose was obtained from potato starch. From the known nitrogen content of the various starches, the net yields of hemicellulose were calculated as sago 3.8, maize 3.6, tapioca 1.7, wheat 1.35, and rice 1 per cent.

The method found most satisfactory for purifying the hemicellulose consisted in dissolving it in 2 per cent NaOH solution and adding copper sulphate until no further precipitation took place. The copper compound was then separated by centrifuging, washed repeatedly with 0.2 per cent NaOH, and decomposed with dilute acetic acid. The liberated hemicellulose was washed with dilute acid and then with graded strengths of alcohol and with ether and finally air dried.

The purified hemicellulose was found to have a composition corresponding to  $C_{18}H_{34}O_{17}(3C_6H_{10}O_5 + 2H_2O)$ . On hydrolysis with dilute acids it yielded glucose as the only reducing sugar, together with small amounts of other products, probably of a dextrin-like character.

III. *The hemicellulose of American white oak*, M. H. O'Dwyer (pp. 501-509).—The hemicellulose of American white oak sawdust was isolated and purified by the methods described in the two preceding papers. The product obtained consisted of a fine grayish white amorphous material free from nitrogen and inorganic matter. It dissolved in boiling water, forming a thin gelatinous mass on cooling, and did not dialyze through parchment nor reduce Fehling's solution.

On hydrolysis the hemicellulose yielded approximately 51.5 per cent of xylose, 18.5 per cent of arabinose, and about 30 per cent of hexoses consisting chiefly of galactose, with a small amount of mannose. A comparison of these hydrolysis products with the elementary analysis of the hemicellulose indicated that the substance is probably a mixture of nearly 70 per cent of xylan and araban and 30 per cent of mannan and galactan.

**Observations on the solubility of insulin**, E. M. P. WIDMARK (*Biochem. Jour.*, 17 (1923), No. 4-5, pp. 668-670).—Insulin is reported to be insoluble or very slightly soluble in tetrachloromethane, ethyl acetate, ethyl alcohol, isobutyl alcohol, amyl alcohol, chloroform, acetone, light petroleum, ethyl ether, benzene, xylene, and pyridin, and easily soluble in methyl alcohol, glacial acetic acid, phenol, and formamid. The fact that methyl alcohol, phenol, and formamid are solvents for albumoses, together with other properties of insulin previously observed, is thought to point to the probability that insulin belongs to the class of albumoses.

**The examination of substances important in agriculture and the agricultural industries.**—I, *Investigations of substances important in agriculture*, J. KÖNIG (*Die Untersuchung Landwirtschaftlich und Landwirtschaftlich-Gewerblich Wichtiger Stoffe*.—I, *Die Untersuchung Landwirtschaftlich Wichtiger Stoffe*. Berlin: Paul Parey, 1923, 5. ed., rev. and enl., vol. 1, pp. XVI+949, pl. 1, figs. 362).—The extensive additions to the subject matter of the previous edition of this reference book (E. S. R., 27, p. 109) have necessitated the separation of the material into two volumes, the first and present one dealing with materials important to agriculture and the second, not yet published, with materials important to industries. The topics considered in the present volume are soils, manures, artificial fertilizers, ashes, feeding stuffs, cereal grains, drinking water and sewage, and damage to vegetation by smoke and dust.

**Bromoxyleneol blue: A true-neutrality point indicator**, A. COHEN (*Biochem. Jour.*, 17 (1923), No. 4-5, p. 535).—Dibromoxyleneol sulphonephthalein or bromoxyleneol blue, the bromo-derivative of xylenol blue (E. S. R., 47, p. 609),



has been found to have the same range of utility as an indicator as bromothymol blue and to have the advantage of being more easily prepared. The method of preparation consists in adding in the cold, with constant shaking of the reaction flask, 3.1 parts of bromin to 1 part of xylenol blue suspended in 10 parts of glacial acetic acid. The pale pink crystals which form on standing are drained by suction and recrystallized from dry boiling toluene.

The indicator can also be used with bromocresol purple as a single mixed indicator (E. S. R., 48, p. 109).

**Further contribution to the nephelometer apparatus and the method of nephelometric determinations,** H. KLEINMANN (*Biochem. Ztschr.*, 137 (1923), No. 1-3, pp. 144-156, figs. 3).—Slight modifications in the original Kleinmann nephelometer (E. S. R., 45, p. 412) are described which are thought to meet the criticisms of Weinberg (E. S. R., 47, p. 507) and others. A micro modification of the original apparatus suitable for use with very small volumes (1.5 to 2.6 cc.) is also described, together with a new turbidity standard.

**A method for the nephelometric determination of small amounts of calcium,** P. RONA and H. KLEINMANN (*Biochem. Ztschr.*, 137 (1923), No. 1-3, pp. 157-183, figs. 3).—A nephelometric method is described for the determination of small amounts of calcium, especially in blood analysis. The reagent employed is sodium thioricinoleate (Merck). Of this substance 10 cc. is dissolved in 112 cc. N NaOH and the volume made up to 125 cc. The reagent is so sensitive to traces of calcium that the solution must be made with conductivity water and kept in paraffin-lined containers.

In the application of this method with the use of the micro apparatus, it is said to be possible to determine the calcium content of 0.25 cc. of blood, using 0.4 cc. of the reagent. In testing the influence of various factors on the reaction, it was found that the turbidity is stable after about 3 minutes and remains unaltered for about 15 minutes. The reaction is not affected by the addition of acetone up to 5 drops, ammonia up to 16 drops of 5 N solution, and ammonium chlorid or sodium chlorid up to 6 drops of N solution. It is thus possible to dissolve an ash to be tested in 3 drops of N HCl and make it alkaline with 5 or 6 drops of N  $\text{NH}_4\text{OH}$  for the nephelometric determination. The final volume may lie between 1 and 12 cc. The probable error of the method is said to be about 1 per cent.

**On the estimation of starch.—I, The estimation of starch in barley and in wheat,** A. R. LING (*Jour. Inst. Brewing*, 28 (1922), No. 11, pp. 838-853, fig. 1; *abs. in Jour. Soc. Chem. Indus.*, 42 (1923), No. 6, pp. 48T-50T, fig. 1).—The method described depends upon the observation that "when starch is hydrolyzed by malt diastase, under suitable conditions, an apparent resting stage is reached when 84.4 parts of maltose, measured by the reducing power, has been produced from 100 parts of anhydrous starch." Graphs have been prepared from the results of determinations of maltose produced under these conditions from wheat and barley starches of known purity with malt of varying diastatic power. The diastatic powers of the malt are plotted as ordinates and the percentages of maltose produced from the dry starch as abscissae. Having determined the percentage of maltose produced from the unknown sample of starch under certain standard conditions, the percentage of starch is calculated by the formula

$$S=94.73 \text{ } M' \div M$$

in which S is the percentage of starch in the sample, M is the percentage of apparent maltose produced from dry barley or wheat starch by the action of malt extract from malt of a definite diastatic power, and M' is the percentage of apparent maltose produced from the sample under the same conditions and with malt of the same diastatic power.



The technique of the determination is essentially as follows: About 5 gm. of the finely ground grain is weighed accurately into a paper thimble which is then extracted in a Soxhlet extractor with alcohol of specific gravity 0.92 for from 3 to 3½ hours. After the extraction the thimble is allowed to drain for a few minutes and the contents then washed into a 300-cc. beaker with about 100 cc. of distilled water. The starch is gelatinized by boiling the contents of the beaker, with constant stirring, for 10 minutes and is then cooled to 57° C. and placed in a water bath at that temperature. Ten cc. of extract from a malt of known diastatic power is added to the paste, and the hydrolysis continued at 57° for an hour, with occasional stirring. The liquid is then boiled, filtered into a 200-cc. graduated flask, and the filtrate and washings made up to 200 cc. Of this solution, 30 cc. is diluted to 100 cc. and titrated against 10 cc. of Fehling's solution. A blank experiment with water and malt extract only is run under the same conditions.

**The estimation of starch.—II, The estimation of starch in potatoes,** A. R. LING and W. J. PRICE (*Jour. Inst. Brewing*, 29 (1923), No. 9, pp. 732-734, fig. 1).—Using the method outlined in the above paper, a curve has been constructed for the percentage of apparent maltose produced from pure potato starch by the use of malt of varying diastatic power. The curve runs almost parallel with that for barley and wheat starch, the only difference being in the larger amount of maltose formed in the case of potato starch. In the starch determination the potato pulp was first extracted with water to free it from reducing sugars. This method was found to give as satisfactory results as those obtained by extraction with alcohol.

**The detection of olive oil in some refined vegetable oils,** W. H. DICKHART (*Amer. Jour. Pharm.*, 95 (1923), No. 9, pp. 684-686).—For the color test described, two solutions are required. Solution A is a solution of 1 part of concentrated sulphuric acid in 4 parts of absolute alcohol, and Solution B is a 2 per cent alcoholic solution of furfural. The test is conducted as follows: To 5 cc. of the sample in a test tube is added 5 cc. of Solution A. The mixture is shaken to form an emulsion, and 10 drops of Solution B are then added. A pink color at this point denotes sesame oil. If no color develops the tube is placed in a water bath at from 94 to 95° C. and heated for 1½ minutes, with frequent shaking. The tube is then removed from the bath and, after the addition of 10 cc. of water with thorough shaking, is allowed to stand for 5 or 10 minutes. The development of a red color is said to indicate the presence of olive oil. Samples of refined cottonseed, soy bean, peanut, tea-seed, and corn oil containing from 2 to 5 per cent of olive oil were found to give a definite red color, while the oils alone gave a milky solution when treated in the same way.

**Citric acid,** C. P. WILSON (*Chem. and Metall. Engin.*, 29 (1923), No. 18, pp. 787-792 figs. 8).—A description is given of the process of manufacturing citric acid from cull lemons.

## METEOROLOGY.

**Meteorology:** The science of the atmosphere, C. F. TALMAN (*New York: P. F. Collier & Son Co.*, 1922, pp. 384, pls. 21, figs. 35).—This book is one of the Popular Science Library series. Chapter titles are anatomy of the atmosphere, resources of the atmosphere, the atmosphere as a highway, dust and smoke in the atmosphere, weather and weather instruments, cloudland, precipitation, winds and storms, atmospheric electricity, atmospheric optics, atmospheric acoustics, climate and climates, organized meteorology, weather maps and forecasts, agricultural meteorology, commercial meteorology, marine meteorology,

aeronautical meteorology, military meteorology, medical and physiological meteorology, weather making, and atmospheric byways. A useful glossary of meteorological terms is appended.

The chapter on agricultural meteorology deals with the significance of critical period of crops, application of the theory of correlation and of phenological observations to weather and crops, and the use of index plants and of the bioclimatic law as proposed by Hopkins. Brief reference is also made to the special forecasts of the U. S. Weather Bureau for the benefit of rural industries, such as frost forecasts; "predictions, three or four days in advance, of favorable weather for cutting alfalfa; forecasts of weather unfavorable for sheep shearing; notices to fruit growers of dry-weather periods in which fruit trees should be sprayed; and warnings of the occasional summer showers that would do so much damage to the great raisin-drying industry of California."

**The new air world: The science of meteorology simplified**, W. L. MOORE (*Boston: Little, Brown & Co., 1922, pp. XIII+326, pls. 20, figs. 28*).—The author states in the introduction that "this book is planned for the reading of those . . . who desire to become weatherwise and make forecasts for themselves, and to apply their knowledge to their business, their health, and their happiness; and for the reading of the more advanced pupils of the public schools."

The different chapters deal with atmospheres of the earth, the sun, and the planets; a synoptic picture of the air; explorations of the atmosphere; earth's four atmospheres; light, heat, and temperature; the advantage of taking weather observations and applying them to one's personal needs; frost; wind and pressure of the globe; how to forecast from the daily weather map; climate; how climate is modified and controlled; civilization follows the storm tracks; has our climate changed; climates for health and pleasure; condensation; and development of the American weather service. A detailed index is included.

**Instructions for aerological observers**, W. R. GREGG ET AL. (*U. S. Dept. Agr., Weather Bur., 1921, pp. 115, pls. 14, figs. 35*).—This document deals in detail with the construction, care, and use of kites and balloons for aerological investigations.

**Modern weather forecasting**, S. L. BASTIN (*Jour. Bath and West and South. Counties Soc., 5. ser., 17 (1922-23), pp. 30-44*).—This article deals with weather forecasting in the British Isles, pointing out that the difficulty of forecasting there is increased by the fact that the weather is controlled from the west and there are few reports from the ocean side upon which to base forecasts. The main features of the British meteorological service, including forecasts for farmers, are briefly described. Amateur and voluntary observations and long distance forecasting are also discussed. The "curious fact that the clouds nearly always disappear to a large extent when the moon is full or nearly so" is noted.

**The solar prelude of an unusual winter**, C. G. ABBOT ET AL. (*Natl. Acad. Sci. Proc., 9 (1923), No. 6, pp. 194-198, fig. 1*).—Observations at Mount Harqua Hala, Ariz., and Mount Montezuma, Chile, from October, 1920, to September, 1922, inclusive, show a remarkable decrease in the amount of heat radiated by the sun during 1922 and continuing through the early months of 1923. This appears to have been associated with anomalous weather conditions during the winter of 1922-23. "While it is far too early in the study of the relations of solar radiation and weather to state that the extraordinary solar change caused the unusual winter weather, it does no harm to draw attention to both, in the hope of attracting investigation."



**Sun spots and their relation to climate**, H. I. JENSEN (*Queensland Agr. Jour.*, 19 (1923), No. 5, pp. 377-379).—Calling attention to the severe drought which prevailed in Australia during the past year and reviewing the recurrence of such droughts in Australia and elsewhere, the author is confirmed in his conclusion that periods of world-wide drought are synchronous with sun spot minima, as previously noted (E. S. R., 16, p. 751).

"We can now see that it is no mere coincidence that the years 1811-12, 1844-1846, 1864-1869, 1896-1902, and 1922 were years of severe world-wide drought. These are all sun spot minimum periods. The Nile in 1902 was the lowest on record, but this year it was nearly as low. The year 1901 was exceptionally dry in Siberia. . . . So also were the sun spot maximum years 1864, 1870-71, 1893-1896 years of wet seasons in most parts of the world. The Rothesay rainfall records, the most complete in the world, show the greatest droughts to have occurred in 1822, 1855, 1887, sun spot minimum years. . . .

"It is obvious that if we know the cause of these periodic droughts of world-wide extent, and if we can forecast them with some degree of accuracy, we can prevent a great proportion of the loss and suffering resulting from them."

**Absorptive action of atmospheric ozone on the ultra-violet rays of the sun**, R. DIETZIUS (*Met. Ztschr. [Brunswick]*, 40 (1923), No. 10, pp. 297-301).—Reviewing the work of Fabry and Buisson, Fowler and Strutt, Schanz, and others, the author calls attention to the important physiological effects on animal life and plant growth resulting from the absorption of ultra-violet rays of the sun by the ozone of the air.

**Rainfall interception by plants: An experimental note**, H. DE FOREST (*Ecology*, 4 (1923), No. 4, pp. 417-419).—Reference is made to observations by Marloth<sup>1</sup> and the author which, contrary to the conclusion reached by Horton as previously noted (E. S. R., 42, p. 317), "would seem to show that, in the case of certain types of crop plants at least, it is still doubtful whether an interception loss occurs. With the hydrometeors of rain and fog, under certain conditions of wind velocity, it seems not unlikely that interception gains instead of interception losses may be customary with certain types of vegetative growth."

**The "Indian summer" as a characteristic weather type of the eastern United States**, R. DEC. WARD (*Amer. Phil. Soc. Proc.*, 62 (1923), No. 2, pp. 48-56, fig. 1).—This article deals with the characteristics, origin of the name, and time of occurrence of this type of weather. A very generalized sketch map, based on daily weather maps for autumn days of marked Indian summer characteristics, is given which shows "in broad outline the general distribution of pressure, winds, and weather during these Indian summer periods."

This map, which is generally typical for the eastern United States, shows a dominant anticyclone central over the southern Atlantic coast and a moderate depression over the Lakes. "Generally clear weather prevails, with some cloudiness and perhaps scattered local showers over the Upper Lake region. There are gentle southerly to southwesterly winds or calms, hazy skies, and temperatures above the seasonal average, with fairly well-marked diurnal ranges, giving cool, pleasantly refreshing nights." Attention is called to modifications of the type which may occur.

It is shown that the popular impression that Indian summer comes after a severe frost in autumn is erroneous and that weather of this type may occur at any season of the year.

---

<sup>1</sup> So. African Phil. Soc. Trans., 16 (1905), pp. 97-105.



[Meteorological summaries for England and Wales] ([*Gt. Brit.*] *Registrar Gen. Statis. Rev. England and Wales*, 1922, pt. 1, pp. 488-491).—Tabular summaries are given of temperature, rainfall, and sunshine for different sections of England and Wales during 1922, and of similar data for Greenwich, 1873-1922, with averages for the 50 years 1861-1910.

[Meteorological observations at the Enological Station of Requena, 1922] (*Estac. Enol. Requena, Resumen Trab.*, 1922-23, p. 21).—Tabular summaries are given of observations on pressure, temperature, rainfall, wind, and other meteorological phenomena for each month of the year.

### SOILS—FERTILIZERS.

Calculation of the probable soil error in paddy trials, G. G. AUCHINLECK, J. C. DRIEBERG, and R. D. KADRAMER (*Trop. Agr. [Ceylon]*, 60 (1923), No. 5, pp. 274-279, pl. 1).—In this paper an attempt has been made to determine the errors which arise from initial differences in the fertility of the soil of various parts of an experimental field. The field used was the leveled bottom of a narrow ravine subject to irrigation. The results indicate that on land of this class, under careful methods of control, plats used for comparative trials should be not smaller than 700 sq. ft. Quadruplicate plats, each of 1,000 sq. ft., would probably differ from one another by not more than about 6 per cent of their mean.

[Soil studies at the Wellcome Tropical Research Laboratories, 1922], A. F. JOSEPH (*Wellcome Trop. Research Labs., Chem. Sect. Pub.* 26 (1923), pp. 12-18).—Mechanical and chemical analyses of soils from different parts of the Sudan are briefly presented and discussed, showing that for good and bad yielding plats, taken from the same area and in the same season, there is a correlation between the soluble salt content and the yield.

Studies of the effect of irrigation with Blue Nile water on the salt content of the soil showed that, while irrigation in each case raised the salt content, the increase bore no relation to that calculated from the known amount of Nile water applied.

Studies of the water-holding capacity of various soils which included about 800 determinations are said to have shown that the moisture equivalent of a normal soil diminishes as the weight of soil taken for the determination increases. With soils impervious to water the moisture equivalent was found to increase with the weight of soil used and became very large owing to water-logging. Dilute solutions of flocculating salts such as calcium sulphate or ammonium nitrate or sulphate reduced the moisture equivalent, and sodium carbonate increased it. As the concentration of sodium carbonate gradually increased the moisture equivalent first decreased, then increased to a maximum, after which there was a further decrease. Soils which were easily water-logged had a higher concentration of hydroxyl ions than those which were not. While the colloidal content of a clay seemed related to its moisture equivalent, no such relation was found to exist for a substance such as kaolin or aluminum hydroxid.

Studies of H-ion concentrations of soils showed that under ordinary temperatures the pH values of soil extracts gradually diminished, the effect being shown more rapidly when the soil water mixtures were kept in an oven at 74° C. The data are said to have indicated that the contact of the soil minerals with an electrolyte solution caused the dissolution of iron and aluminum, which by their hydrolysis reduced the alkalinity of the solution. On the other hand, the action of water on the sodium compounds in the soil caused the production of fresh alkali. Usually the former action was much more rapid than the



latter, thus accounting for the decrease in alkalinity. Boiling permitted a slower action to overtake the more rapid one, and the extract gradually became more and more alkaline.

**The seasonal variation of the soil moisture in a walnut grove in relation to the hygroscopic coefficient,** L. D. BATCHELOR and H. S. REED (*California Sta. Tech. Paper 10* (1923), pp. 31, figs. 7).—Studies on seasonal changes in the soil moisture in an alluvial fine sandy loam soil with a low organic matter content in a walnut grove and on various factors which affect soil moisture are reported.

The results showed that at the end of the growing season the moisture was reduced to a point near the hygroscopic coefficient, in spite of summer irrigations totaling 12.5 acre-inches for the season. After a period of 169 days without a rain of 0.3 in. or more, the moisture in the upper 5 ft. of this soil varied from 0.54 to 0.85 of the hygroscopic coefficient. The moisture content of a different soil type in a 3-year-old peach orchard and in a 6-year-old apricot orchard showed a similar degree of dryness at the same state of the growth cycle of the trees, the average moisture content in the upper 3 ft. of the former being 0.82 and in the second foot of the latter 0.86 of the hygroscopic coefficient.

In spite of the low moisture content of the soil in the latter part of the growing season, the trees showed no permanent wilting, but continued to mature and entered the dormant period without apparent injury. Temporary wilting occurred only during the middle of the day when a high temperature was accompanied by a low humidity. The moisture content of the soil was generally at the hygroscopic point at the end of the growing season, whatever the amount of water present at the beginning.

The moisture content of the upper 7 ft. of the soil gradually increased with the winter rainfall and usually reached a maximum percentage in March, when it was from 2.5 to 3.5 times the hygroscopic coefficient. Early in April the amount of soil moisture was reduced as the trees started their spring growth. The soil moisture of the upper 4 ft. was approximately at the wilting point by the middle of June. The residual moisture from heavy winter irrigation persisted in the subsoil until the middle of the growing season, but by the end it was gradually taken out of this area. Summer irrigations of 4.2 acre-inches raised the water content for a brief time, but within 30 days it dropped back to the approximate value of the wilting point. Such irrigation had little effect on the water content of the soil below the fourth foot.

These results are taken to indicate that the hygroscopic coefficient is the most logical point upon which to base all calculations relating to the moisture content of the soil.

**Osmotic pressure of the soil solution,** M. K. LEVAL'T-EZERSKIĬ (*Zhur. Opytn. Agron.*, 1920; also *Soobshch. Otd. Pochroved. Selsk. Khoz. Uchen. Kom. Narod. Komis. Zemled.*, No. 32 (1921), pp. 11, figs. 4).—The author reviews the work of others bearing on the subject, and concludes that the osmotic pressure of the soil solution is proportional to the depression of its freezing point. He also concludes that the Schiller formula is inaccurate when applied to the osmotic pressures of soil solutions.

**Some properties of soil colloids,** A. N. SOKOLOVSKIĬ (*Izv. Petrovsk. Selsk. Khos. Akad. (Ann. Acad. Agron. Petrovsk.)*, 1919, No. 1-4, pp. 85-225, figs. 2).—The results of a series of studies on soil colloids are presented in some detail, leading to the general conclusion that soil colloids represent the active portions of soils and govern their physical and chemical properties, and that the absorptive capacities of soils are proportional to their contents of colloidal material. Ammonia absorption was found to be greater in soils rich in lime,



which is said to be the dominating factor in the formation of the black chernozem soils of south Russia.

It is further concluded that soil acidity depends more on the inability of soils to adsorb bases than on the actual amount of acids present. Soil is considered to be a chemical compound in a condition of critical instability, in that when depleted of absorbed calcium marked changes occur in its physical properties resulting in decreased absorption by its colloids. This is said to be taking place in the north where the adsorbed calcium of the black soils is being transformed into calcium carbonate, and in the south where the absorbed calcium is being replaced by sodium. The maximum adsorbed calcium saturation was found in black soil and the minimum in podsol and alkali soils. This degree of saturation with adsorbed calcium is considered to indicate the conditions governing the origin of soils in large measure. The loess soils of southern Russia, while having a high total calcium content, are said to have a low saturation of adsorbed calcium. This is taken to indicate that these loess soils are formed practically without the action of water.

Soil colloids are classed in two groups, namely, those connected with adsorbed calcium and those which are independent of adsorbed calcium and in which organic and inorganic colloids play the important parts. The first group is considered to influence soil structure actively, while the second is considered to have no such influence. The two groups are said to be about equal in amount in the black soils.

**Soil aeration**, L. G. ROMELL (*Internatl. Rev. Sci. and Pract. Agr.* [Rome], n. ser., 1 (1923), No. 2, pp. 281-297, figs. 2).—In a contribution from the Swedish Institute of Experimental Forestry a review is given of results obtained, largely by others, on the factors influencing soil aeration. From this it is concluded that normal aeration is affected essentially by factors of so-called continuous action and not by very markedly intermittent factors. In the experimental work the factors considered are temperature, atmospheric pressure, water, wind, and diffusion.

The results are taken to indicate that the aeration of the forest soils of Sweden is due practically to diffusion. Aeration is as a rule sufficiently general in the podsol soils in their natural compact condition, even if a very thick layer of crude humus is present beneath the mineral soil. It was further found that good aeration does not depend upon the work of earthworms nor on a crumbly texture, and the very favorable effect often noticed after the partial breaking up of the soil of crude humus land is not due to improved aeration. As a rule, aeration was found to be defective in damp soils and likely to be insufficient in clays.

**Measuring soil temperature by standard thermometer suspended in iron pipe**, A. B. CONNELL (*Ecology*, 4 (1923), No. 3, pp. 313-316, fig. 1).—In a contribution from the Yale School of Forestry the results of an experiment carried out to determine the relative value of a thermometer inclosed in a special form of iron pipe for measuring soil temperature at a depth of 2 ft., as compared with a standard soil thermometer, are reported.

The readings of the standard thermometer in the iron pipe followed those of the standard soil thermometer very closely, the variation rarely exceeding 0.5° F. During the period of progressive lowering of the soil temperature, extending over the early part of the winter, the readings in the iron pipe were uniformly lower than those of the standard thermometer due to the progressive lowering of the atmospheric temperature. On one or two occasions, however, they rose above the readings of the standard soil thermometer in response to a prolonged rise in the atmospheric temperature. A slight daily fluctuation was noted between noon and evening readings in the thermometer in the iron pipe.



The results are taken to indicate the practical efficiency of the iron pipe in measuring soil temperatures at a depth of 2 ft. or more for all of the field work, at least where air temperatures are not high.

**Soil survey of Marengo County, Ala.,** S. W. PHILLIPS ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+555-597, fig. 1, map 1*).—This survey, made in cooperation with the Alabama Department of Agriculture and Industries, deals with the soils of an area of 618,240 acres in the Coastal Plain region in west-central Alabama. The topography ranges from nearly level to rolling and hilly. Drainage is said to be well established in the rolling and hilly sections, but in the broad bottoms where the streams are sluggish the drainage is insufficient in places and small areas of swamp are developed.

The soils are said to include a great variety of types differing widely in color, texture, and structure. Except in the prairie region of the county, which includes limestone soils, lime and other carbonates have been rather thoroughly leached out of the soils. Including meadow, 28 soil types of 14 series are mapped, of which Oktibbeha clay, Ochlockonee silty clay, and Susquehanna fine sandy loam cover 16.6, 11.5, and 10.8 per cent of the area, respectively.

**Reconnaissance soil survey of Ontonagon County, Mich.,** J. O. VEATCH ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+73-100, fig. 1, map 1*).—This survey, made in cooperation with the Michigan Experiment Station, deals with the soils of an area of 840,960 acres in the northwestern part of the northern peninsula of Michigan. The topographic features consist of level plains representing the beds of old glacial lakes, a hilly division in the southeastern part of the county, a narrow range of knobs in the central part of the county, and the Porcupine Mountains in the northwestern part. The lake bed plains comprise the greater part of the county. The drainage is said to be good throughout the greater part of the county, poorly drained land comprising less than 5 per cent of the area.

The virgin soils in general are characterized by a surface layer of organic matter, but little decomposed or humidified, and a grayish or ash-colored surface soil, underlaid by a brownish layer which in places is slightly cemented into a hardpan. The county is said to contain a wide textural range in soils, including clay, silt loam, loam, sand and stony types. Including rough stony land, peat and muck, and coastal beach, 11 soil types of 6 series are mapped, of which the Ontonagon silt loam and clay and the Porcupine loam cover 29.2, 22.2, and 18.4 per cent of the area, respectively.

**Soil survey of the Chatsworth area, N. J.,** L. L. LEE ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. IV+469-515, pl. 1, fig. 1, map 1*).—This survey, made in cooperation with the Department of Conservation and Development of New Jersey, deals with the soils of an area of 764,800 acres in the Coastal Plain province in southeastern New Jersey. It includes all of Ocean County, about half of Burlington, one-third of Atlantic, and small parts of Monmouth and Camden Counties. The topography is mainly flat and level to gently rolling. Most of the area is said to have adequate drainage, but there are swamps and many depressions and flats that have imperfect drainage.

The soils are predominantly sandy and have been derived from unconsolidated beds of clay, marl, sand, and gravel. Including swamp, tidal marsh, and coastal beach, 28 soil types of 11 series are mapped, of which the Lakewood and Sassafras sands and swamp cover 26.9, 15.4, and 15 per cent of the area, respectively.

**Note on the composition of Canton mud and Chinese fish pond mud,** B. J. EATON and C. D. V. GEORGI (*Malayan Agr. Jour., 10 (1922), No. 9, pp. 238,*



239).—The results of mechanical and chemical analyses of Canton mud and so-called Chinese fish pond mud are briefly presented and discussed. These products are sold in slabs and are said to be used to a large extent for potted plants.

The mechanical analyses indicate that both products are composed principally of very fine soil fractions. While the Canton mud contains about double the plant nutrients in the Chinese fish mud, neither can be termed a fertilizer. It has been found, however, that these muds are very suitable for the cultivation of various potted plants, and they are considered comparatively rich soils.

**On nitrification.**—V, The mechanism of ammonia oxidation, A. BONAZZI (*Jour. Bact.*, 8 (1923), No. 4, pp. 343–363, figs. 2).—In the fifth contribution from the Ohio Experiment Station on the subject (*E. S. R.*, 47, p. 21), studies on the mechanism of ammonia oxidation are reported. The organism used throughout these studies was an active form of *Nitrosococcus* isolated from Wooster soils and kept in Omeliansky solution for over two years without rejuvenation in soils.

Studies of gaseous exchanges during nitrosofermentation indicated that for every atom of nitrogen nitrified three atoms of oxygen are consumed by the organisms from the surrounding atmosphere.

Experiments to determine whether any retarding effect was exerted by iodids in the process of nitrification showed that no deleterious influence was exerted by ammonium iodids upon the process of ammonia oxidation by this organism. No appreciable oxidation of the iodine could be observed in the cultures.

Studies on the changes undergone by a ferrous salt in a nitrifying solution showed that the iron in the uninoculated solutions underwent a very profound oxidation, while in the inoculated solutions it was partly retained in the ferrous form. In addition, when cultures were started in an Omeliansky solution which had been prepared for so long as to have all its iron transformed to the ferric form, tests of the controlled uninoculated solutions failed to give a reaction for ferrous iron, whereas the active cultures yielded a decidedly blue, cellular mass.

Studies of the process of oxidation, particularly to determine whether nitrates are formed in the presence of peroxids in the cold, showed that the bacterial cells in a culture of *Nitrosococcus* or some of their by-products are capable of bringing about the breakdown of hydrogen peroxid. It is concluded that iron by its mechanism of auto-oxidation fulfills in the nitrifying cultures the functions of peroxid, while the cells furnish the mechanism for the liberation of the oxygen thus bound. The change that nitrogen undergoes in passing from the ammoniacal to the nitrous form is considered to be one which involves the valency of the element.

The results are taken to indicate that the process of ammonia oxidation preliminary to the process of nitrification proper is a mechanism in which iron is active by virtue of its property of activating the inert oxygen of the air, and the mechanism itself appears to be intracellular.

**Nitrification and acidity in the muck soils of North Carolina**, L. G. WILLIS (*North Carolina Sta. Tech. Bul.* 24 (1923), pp. 3–13).—Studies of nitrification and acidity in muck soils on two experimental farms on which the corn yields have gradually decreased are reported. Both farms are located on the level Coastal Plain about 15 ft. above tidewater, and the muck deposits are from 2 to 3 ft. in depth with an underlying subsoil of fine sand, silt, and clay.

These soils are acid, and it is concluded that sooner or later liming will be necessary in order to maintain the yield of corn. Tracts which could not be



adequately drained did not derive the full benefit from liming. This is considered to be due probably to the presence of soluble salts of iron, especially the nitrate. No method is considered feasible for determining the lime requirement of these soils, since the organic nitrogen constitutes a reserve of potential acidity impossible of accurate estimation.

The characteristic acid in these soils was found to be nitric acid, formed by the bacterial oxidation of the organic matter. Applications of potash salts and sodium nitrate were found to be beneficial, but acid phosphate was injurious when used under prevailing systems of management.

**Soil treatments to overcome the injurious effects of toxic materials in eastern North Carolina swamp land**, M. E. SHERWIN (*Jour. Elisha Mitchell Sci. Soc.*, 39 (1923), No. 1-2, pp. 43-48).—Studies on treatments of deep peat soils containing about 90 per cent of organic matter, which had become unproductive apparently through accumulations of iron compounds, are briefly reported. The experiments consisted of 13 cultural treatments crossed by limestone in varying amounts and by fertilizers and manure in constant amounts on both limed and unlimed blocks.

The results showed that kainit aided the corn crop, presumably on account of the effect of its potash in enabling the plant to withstand toxic amounts of iron. The chlorin of kainit apparently also aided the passage of potash into the plant, while the sodium furnished a base to combine with nitrates, resulting in a nontoxic stimulating plant nutrient. In addition, the combination of sodium with nitric acid reduced the amount of ferric nitrate in the soil. Sodium nitrate apparently aided the assimilation of potash by the plant, supplied a beneficial nitrate, and prevented the formation of an excess of ferric nitrate by depressing nitrification. Acid phosphate apparently retarded the entrance of potash into the plant and aided in the accumulation of toxic iron.

Lime at the rate of from 2 to 3 tons per acre gave better results than larger or smaller applications. There appeared to be no direct relation between the effect of lime and the lime requirement of the soil as determined by the Veitch method. The effect of lime on ridged land was not significant, apparently because the ridged land was aerated to a point where it would not retain soluble iron.

**Contribution of peat investigations to the cranberry grower**, A. P. DACHNOWSKI (*Jour. Amer. Peat Soc.*, 16 (1923), No. 3, pp. 96-106, figs. 2).—In this brief contribution from the U. S. Department of Agriculture the relations of peat investigations to the cranberry growing industry are briefly outlined. The importance is emphasized of knowing in what relation to one another layers to peat exist in peat deposits used for cranberry culture, and also of knowing what kind of a structural combination of peat layers can be regarded as the best selection for the growing of cranberries.

**Alkali soils—their reclamation and utilization**, N. M. TULAIKOV (*Mater. Rabot Opytn. Meliorat. Chasti Norod. Komis, Zeml. No. 16, 2. ed., rev. and enl. (1922), pp. 236, figs. 6*).—This is the second edition of this book, which gives an account of a study, made by the author, of the reclamation and utilization of alkali lands in the United States, together with a summary of American literature on the subject. Data are also included on alkali lands in European Russia, particularly those occurring in Turkestan, where the area of alkali lands has increased considerably during the past few years as a result of the operation of irrigation works in the Baku and Samarkand districts.

**The depletion of soil phosphorus**, W. H. VOSKUIL (*Amer. Fert.*, 59 (1923), No. 2, pp. 32-37).—Analyses of soils from selected areas of several States for the total phosphorus content are presented and discussed.



These indicate, in general, that the soils of late glaciation are of higher fertility with reference to phosphoric acid content than those of early glaciation or of old unglaciated uplands of the Southern States. Soils containing more than 4,000 lbs. of phosphoric acid per acre are few, and in most cases, especially in the soils of the older agricultural States, the content is considerably below that figure.

The methods by which phosphorus is lost from the soil are enumerated, and means for the conservation of soil phosphorus are outlined. Special attention is drawn to the difference between total and available soil phosphorus. It is stated that results obtained in Wisconsin indicate that a soil containing less than 3,000 lbs. per acre of phosphoric acid solution in N/5 nitric acid will be benefited by the application of phosphatic fertilizers.

**The economics of concentrated fertilizer**, W. H. ROSS and A. R. MERZ (*Chem. and Metall. Engin.*, 29 (1923), No. 8, pp. 313-315).—In a contribution from the U. S. D. A. Bureau of Soils, sources of plant nutrient materials are discussed. A table is given showing the chemical and physical properties of a number of inorganic materials which contain one or more of the essential constituents of fertilizers.

**Artificial fertilizers**, A. KWISDA (*Kunstdünger, Handelsdünger. Leipzig: Waldheim-Eberle, 1922, pp. 111, figs. 12*).—This handbook brings together considerable practical information on the selection, purchase, and rational use of commercial fertilizers, particularly in German agriculture. The information is said to be based on the results of a large number of experiments conducted over a wide range of conditions. Descriptions of fertilizer distributing machinery are included.

**Chemical fertilizers on prairies**, P. HOC (*Jour. Agr. Prat., n. ser.*, 39 (1923), No. 16, pp. 314-317).—The results of experiments on the use of chemical fertilizers on pasture soils growing different hay crops are briefly summarized. The results are taken to indicate that the rational use of chemical fertilizers on such soils permits, by a modification of the flora, not only marked increases in yield but the enrichment of the hay in nitrogen and phosphorus.

**Mixed fertilizer, Bank Centrals' Standard, v. no fertilizer; experiment in Binalbagan district**, H. A. L[EE] (*Sugar Cent. and Planters News*, 4 (1923), No. 1, pp. 21-24, figs. 2).—The results of an experiment with mixed fertilizer applications on first ratoon cane of the Negros Purple variety in the Binalbagan district in Negros are presented. The field was fairly level but very low and poorly drained. The plats receiving mixed fertilizer showed marked increases over the unfertilized plats.

**Fertilizer constituent tests at Bacolod**, H. A. L[EE] (*Sugar Cent. and Planters News*, 4 (1923), No. 5, pp. 226-238, figs. 3).—Experiments conducted by the investigations staff of the Philippine Sugar Association on the use of different fertilizer constituents on sugar cane are reported.

The results showed that phosphates or potash alone gave no increased yields on Bacolod soils. On the other hand, nitrogen applications gave greatly increased yields in the absence of other constituents. It is considered possible that, although potash or phosphates alone gave no increases, increases may be obtained by the use of these materials when the nitrogen deficiency is supplied.

**Production, care, and use of farm manure**, R. E. STEPHENSON and S. C. JONES (*Ky. Agr. Col. Ext. Circ. 155* (1923), pp. 18, fig. 1).—Practical information on the production, care, and use of farm manure in Kentucky is presented in this circular.

**Results with bat guano as a fertilizer in Negros**, H. A. L[EE] (*Sugar Cent. and Planters News*, 4 (1923), No. 7, pp. 331-338, figs. 2).—Experiments on the



value of low nitrogen bat guano having a high phosphoric acid content for increasing sugar yields in the Talisay-Silay and San Carlos districts are reported. Experiments were conducted on typical lowland soils with rather poor drainage. The application was made in furrows on both sides of the cane rows, and the furrows were closed in after receiving the fertilizer. The results showed that this guano did not give increased yields in either district.

**Fixation of atmospheric nitrogen by activated sludge**, C. L. PECK (*Engin. News-Rec.*, 90 (1923), No. 11, pp. 487-489).—Experiments are reported in which it was shown that under certain conditions it is possible to fix atmospheric nitrogen by aeration in the presence of activated sludge. The amount of atmospheric nitrogen so fixed was in some cases equal to 65 per cent of the amount of nitrogen in the sewage. The condition essential to fixation of atmospheric nitrogen seemed to be an environment favorable to the growth of *B. crenothrix*.

Where fixation was successful it was possible to recover 848 lbs. per day of dry humus per 10,000 people contributing to the sewage. The humus had an average ammonia content of 7.92 per cent. The presence in the sewage of 2 parts per million of ferric oxid seemed to be essential, and a detention period in aeration in excess of six hours was apparently necessary. The quantity of air used was not a controlling factor so long as a healthy aerobic sludge was maintained.

**The efficient recovery of nitrates from caliche**, J. W. TURRENTINE (*Indus. and Engin. Chem.*, 15 (1923), No. 8, pp. 853-855).—In a contribution from the U. S. Department of Agriculture a discussion is given of the Chilean nitrate situation, with particular reference to the inefficiency of the present processes used and the difficulties confronting the industry. Possibilities of improvement which will include the utilization of by-products and the more efficient production of high-grade nitrate are suggested.

**Utility of mineral phosphates for direct fertilization**, H. HILBERT (*Chem. Ztg.*, 47 (1923), No. 74, pp. 525-527).—A brief summary of information on the subject is given. For the most part this is apparently favorable to the direct use of raw phosphates on crops, particularly under the conditions existing at present in Germany.

**An inquiry into the question of the saving of a part of the phosphatic fertilizers in Germany**, F. AEREBOE (*Internatl. Rev. Sci. and Pract. Agr.* [Rome], n. ser., 1 (1923), No. 2, pp. 298-304).—A summary of data on the phosphate situation in Germany is presented, with particular reference to the supplies of phosphoric acid in the soil. Soil tests have apparently shown that there are larger supplies of total phosphoric acid in the soil than is generally suspected, and that the main difficulty lies in making it available to crops. Lupines and serradella especially seem to be able to assimilate soil phosphoric acid. It is concluded that the cultivation of lupines and serradella on a large scale, which should be partly grazed and partly used in the stable as forage, must increase the supply of phosphoric acid for the farm.

**Mining and washing phosphate rock in Tennessee**, R. W. SMITH (*Engin. and Mining Jour.-Press*, 115 (1923), No. 5, pp. 221-226, figs. 9).—The geology of the principal Tennessee phosphate rock deposits is briefly described, and the processes involved in the mining and washing of the rock are briefly outlined and illustrated.

**The constitution and manurial value of low grade basic slag**, D. N. MCARTHUR (*Jour. Soc. Chem. Indus.*, 42 (1923), No. 20, pp. 213T-216T).—Studies conducted at the West of Scotland Agricultural College are reported, which included microscopical examinations and pot and field experiments with

low grade basic slag to determine its composition and manurial value. The slag was the by-product of the open-hearth process for steel manufacture.

The results indicated that open-hearth fluorspar slags of low phosphate content have a distinct fertilizing value in their lime content, and can be used to replace ground limestone in agricultural practice. The fineness of division of a slag was found to be important, the finely ground material being more available than the coarsely ground material.

**The French potash industry**, M. MENNECKE (*Amer. Fert.*, 59 (1923), No. 5, pp. 23-26).—The Alsatian potash industry is briefly described.

**Leucite in agriculture**, G. DE ANGELIS D'OSSAT (*Internatl. Rev. Sci. and Pract. Agr.* [Rome], n. ser., 1 (1923), No. 2, pp. 305-316, pls. 2, fig. 1).—In a contribution from the Royal High Institute of Agriculture in Perugia, a summary of information and of experimental data relating to the value of leucite as a source of agricultural potash is presented. The consensus of opinion seems to be favorable to leucite as a potash fertilizer.

**The recovery of potash from waste molasses**, R. R. HIND (*Sugar Cent. and Planters News*, 4 (1923), No. 1, pp. 16-19, fig. 1).—The process of recovering potash from waste molasses in a molasses burning plant and utilizing the heat of combustion is outlined and illustrated.

**Lime and liming**, J. J. GRIFFITH (*Bath: Herald Press*, 1923, pp. 9).—Practical information on the use of different types of lime on soils, with particular reference to British conditions, is briefly presented.

**Arsenic, a catalytic fertilizer**, C. PICADO (*Compt. Rend. Soc. Biol.* [Paris], 87 (1922), No. 39, pp. 1338, 1339).—The results of experiments with arsenic are briefly summarized, indicating that in very small applications of about 1 kg. per hectare (0.89 lb. per acre) it had a tendency to increase the yield of corn fodder. A progressive increase in the applications indicated that arsenic had no effect on crop yield in amounts greater than 8 kg. per hectare. In such small applications the arsenic apparently did not act as a sterilizing agent. The yield of corn was increased by small applications of arsenic in sterile soil the same as in natural soil. It is concluded that arsenic used in this manner acts as a catalyst.

**Analyses of commercial fertilizers**, H. E. CURTIS, H. R. ALLEN, and L. GAULT (*Kentucky Sta. Bul.* 245 (1922), pp. 237-378).—This contains the results of actual analyses and guaranties of 1,188 samples of fertilizers and fertilizer materials, representing 883 brands, collected for inspection in Kentucky during the year 1922.

**Commercial fertilizers**, J. L. HILLS, C. H. JONES, and G. F. ANDERSON (*Vermont Sta. Bul.* 234 (1923), pp. 3-24).—The results of actual analyses and guaranties of 391 samples of fertilizers and fertilizer materials, representing 144 brands collected for inspection in Vermont during 1923, are summarized and discussed.

## AGRICULTURAL BOTANY.

**Influence of meteorology during 1921 on leaf coloration and fall**, J. BOUGET and A. D. DE VIRVILLE (*Compt. Rend. Acad. Sci.* [Paris], 174 (1922), No. 11, pp. 768-770).—The high temperatures and prolonged dryness during 1921 influenced notably in the region of the Pyrenees, and more or less elsewhere, the coloration and fall of leaves.

**Floral anatomy of a given species at various altitudes**, M. LARBAUD (*Compt. Rend. Acad. Sci.* [Paris], 174 (1922), No. 24, pp. 1562-1564).—Anatomical differences corresponding to altitude are noted. What are here called montane tissue characters, attributed largely to the dryness, are outlined.



**Endurance of high temperatures by embryos of *Helianthus annuus*, E. GAIN** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 15, pp. 1031-1033).—The author claims that a certain percentage of embryos of *H. annuus* can withstand temperatures of 130 to 145 or 150° C., retaining viability.

Certain views with respect to the resistance of mitochondria, also to some physical properties of the living cell, were not supported by these experiments.

**The resistance to heat of growing points in the embryo of sunflower, E. GAIN** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 24, pp. 1557-1559).—Observations following up those above noted have been made on several plants. seeds of which supported temperatures of 110 to 155° C. without destroying germinability. Confirmation was obtained of the conclusions reached by Téodoresco (*E. S. R.*, 33, p. 30) regarding the resistance of disastases to heat.

**The action of temperature on the cellular chondriome. The physical condition for mitochondrial formation, A. POLICARD and G. MANGENOT** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 9, pp. 645-647).—In previous work herein referred to as confirmed by the studies of Cowdry (*E. S. R.*, 38, p. 524), Policard has demonstrated the great sensitivity of mitochondria to high temperatures.

In recent work on filaments of *Saprolegnia*, on epidermal cells of young leaves of iris, and on epidermal cells of petals of tulip (white and yellow), all of which materials permit observation to be easily made on mitochondria in their living cells, the authors studied the effects of temperature on mitochondria, and the results are herein detailed.

Differences of sensitivity appear in different species, the mitochondria of *Saprolegnia* being more sensitive than those of tulip and these more so than those of iris. Supposedly slight differences of sensitivity exist in the mitochondria of the same cell.

Summing up, it appears that in all cells, animal or vegetable, the mitochondria are killed by temperatures of 48 to 50° C. This fact probably offers a test as to the mitochondrial character of an intracellular formation.

**The ascertainment of germinability without employing germination, P. LESAGE** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 11, pp. 766, 767).—A method utilizing coloration as a positive test of seed germinability is described.

**Influence of lime during the germination of seeds, L. MAQUENNE and R. CERIGHELLI** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 20, pp. 1269-1272).—A generally favoring influence as regards development appears to be exercised by lime on the principal portions and yields of different plants tested. Elongation of the roots even at low concentrations is more notable than that of stems, and this is thought to be a fact of general applicability.

**The influence of selenium and of radium on the germination of seeds, J. STOKLASA** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 16, pp. 1075-1077).—Tests were made with *Hordeum distichum*, *Triticum vulgare*, *Secale cereale*, *Avena sativa*, *Vicia faba*, and *Polygonum fagopyrum*, subjected to selenium and radium.

It is stated that germinability and germinative energy in such seeds are greatly favored by radioactivity in the medium, which in such case neutralizes most of the toxic effects of selenium.

**Influence of selenium on plant development with or without radioactivity, J. STOKLASA** (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 19, pp. 1256-1258). In the study of *Hordeum distichum*, *Zea mays*, *Polygonum fagopyrum*, *Vicia faba*, *Soja hispida*, and *Lupinus angustifolius*, it was found that the radioactivity of the medium neutralized completely the toxicity of



sodium selenite on growing plants. Selenium dioxid is much more powerful than sulphur dioxid.

**Root elongation**, H. RICOME (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 13, pp. 880, 881).—What is considered as conclusive proof has been obtained that in roots reaction to gravity occurs in the same sense as in stems. The production of modifications was effected by means described. It was shown by experimentally injuring cells actively dividing that the regions of cellular divisions may exert influence the inverse of that of gravity on zones in a state of division and of elongation, the effect of this being to send the roots downward and the stems upward.

**Tumefaction and tuberization**, J. DUFRENOY (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 26, pp. 1725–1727, figs. 3).—Tumors, nodules, and other dilatations are briefly discussed as noted in *Eucalyptus eugenoides* and *Arbutus unedo*. Certain tumors accumulate, during autumn and winter, in their medullary hypertrophies and hyperplasias, large quantities of amyloleucites, thus showing (incompletely) characters, both anatomical and physiological, of tubers, and offering thus an example of transition between tumefaction and tuberization.

**The distribution of anthocyanidins in colored plant organs**, ST. JONESCO (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 25, pp. 1635–1637).—The anthocyanidins, in so far as concerns colored pigment in a free state, do not exist in all the colored tissues which contain anthocyan. They appear to be characteristic of the pure red organs, whereas a yellow pigment replaces them in blue, violet, or purple red organs.

**The rest period of *Solanum tuberosum* in relation to available nitrogen**, W. NEWTON (*Science*, 58 (1923), No. 1498, pp. 207, 208).—The author presents evidence which is believed to indicate that the slow growth of potatoes during their rest period may be due to a deficiency of nitrogen in the tubers.

Seed pieces of equal weight from resting tubers were planted in quartz sand, and one-half received a complete nutrient solution while the others received the same solution with the exception of the nitrogen. Six weeks later seed pieces of tubers that had passed through their rest period were treated in the same manner. Cultures of both series that received nitrates appeared above ground at about the same time, while those receiving no nitrate were a week or more later in appearing. The sprouts in the nitrate cultures made much more rapid development, the differences being very striking at the end of a few weeks.

The author considers the physiological condition of tubers planted during the rest period to be different from those that have passed the normal rest period, and the breaking of the rest period is believed to be dependent, in part at least, on the presence of a readily soluble nitrogen supply. In nonresting tubers the nitrogen must be supplied by the tuber itself through the hydrolysis of its protein.

The presence of a proteolytic enzym in the expressed juice of the potato has been demonstrated by the author.

**On the adaptation of wheat to growth media deficient in nutrients**, W. F. GERIQUE (*Science*, 57 (1923), No. 1488, p. 17).—The author states that the correlation obtained between the differences in yield of grain of different varieties of spring wheat and that of their relative earliness of ripening suggests a factor that plays no inconsiderable rôle in the adaptation of the variety of wheat for maximum grain production from growth media markedly deficient in essential salt elements. Nine varieties of wheat were grown in such media, and the largest yield of grain was produced by the variety that ripened first and the lowest by the last maturing variety. Seven weeks were



said to have elapsed between the time that the earliest and latest varieties ripened. There was no correlation observed between the total dry weights of the different varieties and their comparative earliness. The plants were grown in tap water, which as a growth medium was considered very deficient in essential salt elements.

No correlation was observed between differences in yield of grain of the different varieties and that of their relative earliness of maturation when they were grown in fertile soil. However, when grown in tap water which had no particular merit other than being a growth medium, deficient in nutrients, the variety of wheat that completed its growth cycle in the shortest period of time was apparently able to utilize the small supply of salt elements most efficiently in the production of grain.

Whether the variety of wheat is early or late the author believes is largely determined by genetic and environmental factors, but the result of these factors as to whether the variety is early or late in no small measure determines to what extent the minimum supply of salt elements in the growth medium can best be utilized for the production of grain.

**Growth in media poor in oxygen,** L. MAQUENNE and E. DEMOUSSY (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 22. pp. 1387-1392).—In certain species the leaves are capable of retaining vitality in absence of air during a considerable period of time.

**Studies on the effects of sodium, potassium, and calcium on young orange trees,** H. S. REED and A. R. C. HAAS (*California Sta. Tech. Paper* 11 (1923), pp. 23, pls. 5).—In a previous publication (E. S. R., 49, p. 628) the authors pointed out the pathological conditions of citrus trees caused by an excess of sodium salts. The present paper deals with the effects produced by the application of solutions containing considerable sodium sulphate to young orange trees grown in sand cultures and with the changes brought about in young orange trees when sodium is substituted for potassium in Hoagland's mixture. The cultural details of the experiment have been described elsewhere (E. S. R., 49, p. 729).

It was found that young orange trees showed serious injury when grown in cultures in which no calcium salts were supplied. When sodium sulphate was added to cultures which lacked calcium the first leaves had a tendency to be mottled, were abnormally curled, and were shed prematurely. Successive crops of leaves were likewise prematurely shed. The shoots grew poorly and had a tendency to form multiple buds, and the roots made restricted growth.

The condition of trees receiving sodium sulphate was much better if calcium salts were also present, although the total amount of growth was less than that of trees receiving a complete nutrient solution.

Orange trees in cultures to which no potassium salts were added made a fair growth, and at the end of 17 months had shown no such injury as those which lacked calcium. There was a tendency for the chlorophyll to fade out, but no premature leaf fall occurred. The sap of the leaves was slightly more acid than that from trees grown in other cultures where they received potassium and sodium salts.

Leaves of trees to which no calcium salts were supplied were very rich in potassium, and, conversely, those receiving no potassium salts were higher in calcium.

The trunks and roots contained higher percentages of sodium than other parts of the tree. The rootlets were richer in phosphate, sulphate, and chlorid ions than other parts of the trees. Where calcium salts were withheld from the trees the trunks and roots were the last to be depleted of calcium. Where

potassium salts were withheld, the roots and rootlets were the last to be depleted of potassium.

**Acidity of corn and its relation to vegetative vigor**, A. M. HURD (*Jour. Agr. Research* [U. S.], 25 (1923), No. 11, pp. 457-469, figs. 2).—A study made of corn plants showed that the H-ion concentration of the tops ranged from pH 5 to pH 5.6 in the five plantings which were covered by the experiments, and was inversely correlated with the degree of vegetative vigor induced by the environmental conditions affecting the different plats. There was a lack of exact correlation between the magnitude of the acidity measurements and the specific gravity determinations of the juices, and this is held to show that, in general, variations in sap density are not responsible for the variations in acid concentration.

The concentration of titratable acid was found always higher in the juice of the leaves than in the stalk, regardless of the plant's vigor. The H-ion concentration was higher in the leaves than in the stalk in the vigorous plants only. In the stunted plants it was greater in the stalks than in the leaves. In the slow-growing plants of the most stunted plat the titratable acid concentration of the stalk was at least one-half that of the leaves, while in the vigorous rapidly-growing plants the ratio was one-third or one-fourth and even lower. The specific gravity of the juice of the leaves was found always higher than that of the juice of the stalk, regardless of the plant's vigor.

Environmental conditions are said to have produced far greater variations in the acidity of plants of the same strain than were ever found between plants of different varieties in the same environment and of equal vigor.

**Acid fermentation produced by *Sterigmatocystis nigra***, M. MOLLIARD (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 13, pp. 881-883).—In the growth of *S. nigra* under nutritive conditions indicated, at least one undetermined acid, besides citric and oxalic acid, is produced.

**Blackened spheres for atmometry**, B. E. LIVINGSTON (*Science*, 58 (1923), No. 1497, pp. 182, 183).—The necessity for black, porous atmometers to be used in connection with white ones in studies of transpiration, radiation, etc., is pointed out, and suggestions are given for the preparation of such blackened spheres.

## GENETICS.

**Some possible bearings of genetics on pathology**, T. H. MORGAN (*Lancaster, Pa.: New Era Ptg. Co.*, 1922, pp. 33, figs. 14).—The author has cited many interesting experiments dealing with inheritance of characters in plants, animals, and man, pointing out their possible relationship to the inheritance of pathological conditions in man. The author believes that there is very little evidence to indicate much positive relationship between genetics and pathology.

**Concerning blood complement**, F. A. RICH (*Vermont Sta. Bul.* 230 (1923), pp. 3-24, pls. 4).—In addition to a brief report of the serological studies of the complement-deficient guinea pigs previously noted by Moore (*E. S. R.*, 43, p. 273), the hereditary behavior of the complement deficiency is described. Matings of complement-deficient males and females were found to produce only complement-deficient offspring, whereas the original matings of deficient males with normal females from the deficient stock produced 11 deficient and 25 normal offspring, and a reciprocal cross produced 1 deficient and 1 normal individual. Matings from the deficient stock of normal x normal resulted in 20 normal and 1 deficient offspring.

These results thus indicated a single factor difference, the normal condition being dominant (C). To test this out the stocks were increased by mating



complement-deficient males with normal and deficient females. There were 5,834 tested offspring produced from parents resulting from crosses in which the genetic constitution of the parents was known. Matings CC×CC, CC×Cc, and CC×cc gave only normal offspring, Cc×Cc gave 907 normal and 302 deficient, Cc×cc gave 711 normal and 690 deficient, and cc×cc gave 2,046 deficient offspring.

Further studies of the complement titer of the deficient animals showed that the variation ranged from 0.3 to 2 cc. To study the possibility of the operation of other genetic factors on this variation, two generations of matings between parents of like complement titer were made, but the offspring showed no tendency to agree with their parents in this respect, though the exclusive use of 1 cc. complement-negative sires seemed to increase the proportion of the deficient stock of animals having a very low complement titer. As an explanation of the occurrence of some complement in the deficient animals, the author suggests a multiple factor hypothesis in which an intensifying factor for complement is lacking in the complement-deficient animals studied, though they all contain the factor for complement.

**Marsupial spermatogenesis**, A. W. GREENWOOD (*Quart. Jour. Micros. Sci.* [London], n. ser., 67 (1923), No. 266, pp. 203-218, pls. 2).—The author reports a cytological study of spermatogenesis in three species of Marsupials from the University of Melbourne. The species used consisted of *Phascolarctus cinereus*, *Sarcophilus ursinus*, and *Dasyurus maculatus*. The diploid chromosome numbers were, respectively, 16, 14, and 14, of which 2 in the males of each were the X- and Y-chromosomes. Material was available so that the chromosome numbers of the females of the first two species were counted and found to be the same as the males except for the presence of 2 X-chromosomes instead of X and Y.

In the spermatogonial plates the autosomes arrange themselves in the form of a circle about central clear spaces in which two very small chromosomes of unequal size (X and Y) are located. The Y-chromosome is very minute. Changes during the different stages of spermatogenesis are described in detail for *Phascolarctus*, and were in general found to be similar in the other two species. Reduction occurred only in the first meiotic division. In *Phascolarctus* the Sertoli cells were found to be very large and possessed conspicuous rod-like bodies, the origin and function of which were not discovered.

**The male meiotic phase in two genera of Marsupials (*Macropus* and *Petauroides*)**, W. E. AGAR (*Quart. Jour. Micros. Sci.* [London], n. ser., 67 (1923), No. 266, pp. 183-202, pls. 3).—A cytological study of the reduction division in males of *M. ualabatus* and *P. volans* is reported from the University of Melbourne.

In *Macropus* the diploid chromosome number in males is 10+XY, which is evidenced in the meiotic division. Ordinarily only 11 chromosomes are visible in the male and 10 in the female, since the X-chromosomes which are small apparently attach themselves to the end of an autosome. The Y-chromosome is very small, but remains separated from the autosomes during mitosis. During the pachytene stage, while the autosomes are still elongated, the X- and Y-chromosomes condense into a bivalent which is attached to an autosome during the first meiotic division.

In the *Petauroides* the diploid chromosome number seems to be 20+XY, though some variation was observed, probably due to the inability to count the segregated chromosomes. In the process of mitosis 20 of the chromosomes form a ring about the two smaller ones, which are in the center. It is assumed that



these two, which are of unequal size, are probably the X- and Y-chromosomes. In making the study it was noted that the chromomeres were very pronounced in *Petauroides*, and conditions permitting crossing over were present in both species. Micrographs showing different stages of spermatogenesis are presented.

**Mutation and inheritance of semisterility in the rice plant**, H. TERAO (*Idengaku-Zasshi* [Japan. Jour. Genetics], 1 (1921), pp. 45-54; abs. in Japan. Jour. Bot., 1 (1922), No. 1, pp. (14), (15)).—A type of plant in which about half of the total spikelets are barren was found in certain pedigree strains of rice which had been otherwise constantly fertile. Two families, each derived from a single plant, contained 1 semisterile for 117 and 114 fertiles, respectively. Each semisterile plant segregated into fertiles and semisteriles, the former breeding true and the latter repeating the same mode of segregation in later generations. In 129 segregating families, the author found a total of 3,923 fertiles (50.91 per cent), and 3,783 semisteriles (49.09 per cent), and he thinks that the segregation ratio is to be regarded as 1:1. This behavior is explained in an English abstract.

**The heredity of the pigments of red rice**, S. KATÔ and Z. ISIKAWA (*Idengaku-Zasshi* [Japan. Jour. Genetics], 1 (1921), pp. 1-7, figs. 3; abs. in Japan. Jour. Bot., 1 (1922), No. 1, pp. (5), (6)).—The reddish brown kernels or so-called red rice, produced by races such as Kuromoro, Akatôbôsi, Haguro, and Akamuro, contain the red pigment chiefly in large cells of their seed coats, and to a lesser extent in pericarp cells. The hybrid Kuromoro (red) × Oobamoti (normal white), as well as its reciprocal, gave rise in  $F_2$  to offspring producing red and white rice, respectively, in the ratio 3:1, while from the hybrid Kuromoro × Wasesinriki (white) the authors obtained in  $F_2$  offspring producing red, yellowish-brown, and white rice in the proportion of 9:3:4. These and crosses between other races and Kuromoro led to the conclusion that three factors are necessary for the production of reddish brown pigment, that Kuromoro contains all of them, and that white rice races contain either two or only one of them. Analysis showed that the reddish as well as the yellowish brown pigments belong to protocyanin and not to anthocyanin. The chemical nature of the pigments in the extremities of glumes and awns of Genkimoti, Sirotôbôsi, and their hybrid is discussed briefly.

**Inheritance of leaf color in purple rice**, Y. TAKEZAKI (*Idengaku-Zasshi* [Japan. Jour. Genetics], 1 (1921), pp. 37-43, figs. 2; abs. in Japan. Jour. Bot., 1 (1922), No. 1, p. (14)).—The so-called purple rice plants are distinguished by purple leaves, sheaths, glumes, and awns, which color arises from the red anthocyanin in the epidermis cells. In the  $F_2$  of Husakiti (green) × Murasaki (purple), and Murasaki × Rokusukegawari (green), segregation of about 27 purple:37 green progeny was observed. Studies of the  $F_3$  and curve analyses suggested the conclusion that the production of purple was possible only through the combination of three factors.

**Inheritance of leaf color in barley**, B. MIYAZAWA (*Idengaku-Zasshi* [Japan. Jour. Genetics], 1 (1921), pp. 9-12; abs. in Japan. Bot., 1 (1922), No. 1, p. (10)).—In one of the  $F_4$  of Tikurin × Goldenmelon barley, green and light yellow individuals segregated in the ratio of 3:1. Selfing of such green individuals gave only green progeny in one case, but in another the same 3:1 segregation took place. The light yellow plants usually soon succumbed, probably because of cold, but when protected they gradually changed into the viable green condition. The yellows were evidently recessives. An agreement with the results of Miles (E. S. R., 33, p. 131) with corn is indicated.

**The hereditary relation of dominant white and blue in chickens**, W. A. LIPPINCOTT (*Poultry Sci.*, 2 (1923), No. 5, pp. 141-145).—The results of experi-



ments in crossing and back crossing Blue-splashed Andalusians and White Leghorns to determine whether the genes *I* for dominant white and (*Re*) for blue (E. S. R., 47, p. 276) belong to the same allelomorphic series indicate conclusively that these genes segregate independently.

**Saving the six-nippled breed**, A. G. BELL (*Jour. Heredity*, 14 (1923), No. 3, pp. 98-111, figs. 10).—This is the last annual summary prepared by the author before his death, dealing with the experiments in the production of multi-nippled and twin bearing sheep at his farm in Nova Scotia. The breeding stock was selected from lambs above the average in weight having four or more well developed and well separated nipples of about equal size. The ewes were bred in October each year, and those not giving birth to twins or more were discarded.

The success of the selection for twin bearing may be estimated by the fact that in the last year 31 lambs were born of which 24 were twins (12 pairs), 6 were triplets (2 sets), and only 1 was born single. An introduction is given by the author's wife, M. G. Bell.

**Abnormality in heredity of embryo color of a *Pisum* variety**, L. BLARINGHEM (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 13, pp. 877-879).—Certain strains of *P. sativum* are found, as in case of flax (E. S. R., 46, p. 32), to present striking irregularities in the transmission of discontinuous characters. It was not possible to verify in strictness Mendel's law. These irregular lines furnish also modes of reaction which are sensitive to climate, age, and particular condition of nutrition.

**Reverse mutation of the bar gene correlated with crossing over**, A. H. STURTEVANT and T. H. MORGAN (*Science*, 57 (1923), No. 1487, pp. 746, 747).—Observations on *Drosophila melanogaster* have shown that bar-eyed flies revert to the wild type in from 30 to 60 individuals per 100,000 of the population. In studying this phenomenon, two experiments have been carried on at Columbia University, and it was determined that the wild-type mutants from bar-eyed or ultrabar-eyed parents resulted from crossing over between the genes forked (locus 56.5) and fused (locus 59.5). The locus for bar lies between these genes. The authors, therefore, conclude that "reversion of bar to normal is associated with crossing over at or near the bar locus."

**Sex differentiation in the viviparous teleost, *Xiphophorus helleri***, J. M. ESSENBERG (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 45 (1923), No. 1, pp. 46-97, figs. 49).—A study of the sex differentiation in males and females of the viviparous teleost (*X. helleri*) is reported from the Hull Zoological Laboratory of the University of Chicago. Not less than 400 specimens of fish ranging in age from birth to maturity were studied, of which 300 were sectioned for cytological examination, and drawings showing the typical sex glands during different stages of differentiation are given. The young fish average about 8 mm. at birth, but sex is not definitely established until they are about 10 mm. in length. This is designated as the indifferent stage. In this stage the gonads, consisting of primordial germ cells and very much smaller elongated cells which surround the germ cells, are small, but they are suspended in a peritoneal sack set off from the surrounding tissue, one on each side of the body cavity.

In the early stages of differentiating the female, the two gonads approach each other until they meet medially and fuse, which is the normal condition of the adult ovary. The primordial germ cells grow and form follicles which degenerate and are absorbed on reaching medium size. Following this degeneration process, referred to as retrogression, germ cells originate from peritoneal cells and form the follicles of the adult. The author observed three different classes of retrogression. In about 50 per per cent of the females (class

1) follicle formation begins in the epithelial cells before retrogression is well advanced. In others (class 2) no follicle formation precedes complete degeneration of the primordial germ cells, but indifferent germ cells are evident in the epithelium before degeneration is complete (ovarian epithelium relatively inactive). In other females (class 3) retrogression is complete before germ cells appear in the epithelium. The fatty tissue surrounding the gonad increases immensely during retrogression in this class. The formation of the ova is not the result of any marked morphological changes in the gonads except that the primordial germ cells gradually enlarge and form oocytes.

The first sex differentiation of the male is largely a matter of tubule formation, which is divided into early, middle, and late stages. In the early stage the peritoneal cells proliferate abundantly, and cause a segregation of the primordial germ cells at the periphery of the testis, by occupation of the center and inner margin by the epithelial cells. This is the beginning of the sex cord. In the middle stage of tubule formation, the sex cord develops a central lumen which is the sperm duct. In the late stage of tubule formation the sperm duct becomes branched and nests of primordial germ cells develop, after which spermatocysts are formed. Beginning in this stage there is a marked thickening of the third ray of the anal fin, which is followed by an elongation of the third, fourth, and fifth rays to twice their original length.

The late sex differentiation of the females and males consists largely of the processes of oogenesis and spermatogenesis. The female containing mature ova may always be designated by the presence of a dark spot on each side in the region of the pelvic fin. The following table gives a summary of the measurements of the male and female fish in the various stages of sex differentiation:

Measurements of fish during sex differentiation.

Stages in development.	Averaged data.		Limits.	Stages in development.	Averaged data.		Limits.
	Form index. <sup>1</sup>	Fin ratio. <sup>2</sup>			Form index. <sup>1</sup>	Fin ratio. <sup>2</sup>	
			Total length of fish in millimeters.				Total length of fish in millimeters.
Indifferent.....	6.26	1.00	0- 9.3	Normal mature females....	5.34	1.28	26.7-80.0
Normal immature females..	5.02	1.13	9.3-16.9	Early tubule formation....	5.17	1.16	9.3-13.5
Retrogression in class 1....	4.62	1.16	16.9-29.5	Middle tubule formation...	4.84	1.27	12.5-18.6
Retrogression in class 2....	4.53	1.17	14.2-29.6	Late tubule formation.....	4.64	1.74	15.7-51.5
Retrogression in class 3....	4.43	1.84	18.4-65.0	Mature males.....	4.20	4.25	31.6-84.4

<sup>1</sup> Length of fish divided by greatest depth.  
<sup>2</sup> Diameter of third ray of anal fin divided by diameter of fourth ray of anal fin.

A study of the sex ratios of immature (10 to 26 mm. long) and mature fish showed that the immature fish were 74 per cent females, whereas according to A. W. Bellamy the mature fish were 75 per cent males. Differential sex viability was shown to be an improbable cause of the reversal, and the possibility of sex inversion is suggested and discussed. Evidence is presented to indicate that all of the linear descendants of primordial germ cells disintegrate. Therefore, the females of the retrogression classes of 2 and 3 probably become males.

Practical observations of sex reversal in teleosts and other animals are reviewed.

On acquired heredity, J. COSTANTIN (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 26, pp. 1659-1662).—The supposed (apparent) persistence of acquired characters is explained as due in certain cases to the influence of causes



acting in effect parallel to that of heredity (alleged) of acquired characters even after the disappearance of the (initial) cause.

**A new method of self-pollinating corn**, M. T. JENKINS (*Jour. Heredity*, 14 (1923), No. 1, pp. 41-44, figs. 4).—After the silks of a bagged ear are visible the end of the husk is cut back, and the tassel of the plant is removed and shaken to eliminate foreign pollen. A "12-lb." paper bag is then slipped over both tassel and ear and fastened in place. The basal portion of the tassel rests in a small bottle of water to prevent its withering before considerable pollen has been shed. It is claimed that this method prevents danger of contamination, and that the ears produced are well filled from base to tip.

## FIELD CROPS.

**Field crops in South Africa**, H. D. LEPPAN and G. J. BOSMAN (*Johannesburg: Central News Agency, Ltd.*, 1923, pp. IX+358, pls. 28).—This volume presents concise accounts of each of the principal field crops grown in South Africa, embracing production statistics, botanical and agronomic characteristics, varieties, cultural methods and field practices, improvement methods, and insects and diseases. Agro-geographical conditions in relation to crop distribution in South Africa; soil management, including tillage, fertilizer practice, and weed control; crop rotation; and dry-land farming are also dealt with in regard to crop production in the country.

**[Cereal breeding work in Italy, 1921-22]**, N. STRAMPELLI (*Nuovi Ann. [Italy] Min. Agr.*, 3 (1923), No. 1, pp. 61-90).—The principal lines of investigation reported on from the Phytotechnic Stations at Rome and Foggia and numerous regional fields comprised selection and hybridization studies with wheat and varietal and adaptation tests with wheat and corn.

**Contribution to the basis of grass and clover culture**, T. REMY (*Landw. Jahrb.*, 58 (1923), No. 5, pp. 655-690).—Field and pot experiments during 15 years concerned the study of the course of the uptake of nutrients and storage of structural and nutrient materials in the subterranean organs of meadow and pasture plants. The principal observations may be summarized as follows:

Persisting clovers and grasses during their first development accumulate considerable nutrients in their rootstocks, about equaling the plant nutrients contained in a year's hay crop. During the summer a partial depletion of the rootstock takes place to the advantage of the aerial portions of the plant. With the approach of autumn and lessening of vegetative growth, the replenishment of the rootstocks occurs annually and attains its peak by the death of the vegetation. Fertilizers applied to meadows in late summer or fall early enough to be taken up before the winter dormancy are deemed as effective as those applied correctly after winter.

Plat tests with grasses and clovers, seeding and nitrogenous-fertilizer trials on meadows, and cultural experiments with alfalfa are reported on briefly.

**The wintering of perennial legumes**, F. WAHLEN (*Landw. Jahrb. Schweiz*, 37 (1923), No. 2, pp. 103-134, figs. 3).—Investigations of the winter habit of red clover, alfalfa, and sainfoin (*Onobrychis viciifolia*), from lowland and mountain sources, are described in detail.

The legumes studied did not appear to possess autonomic winter dormancy. A weak bud growth during the warmer winter days seemed to indicate that root growth also continued. The contraction of the taproot did not vary greatly in the different species, that of *Medicago sativa* averaging 12.86 per cent, *M. falcata* 13.68, meadow red clover 10.4, cultivated red clover 5.13, and sainfoin 6.38 per cent. The primary branch roots were also seen to shrink, and the hypocotyls of the legumes had considerable contractility.

Reserve material found in the roots of the legumes included albumin and amids, nitrogen-free extract principally in the form of starch, hemicellulose, and a small amount of fat. Hemicellulose was derived from starch during autumn and early winter.

The specific weight of the root gives a useful index to the content of reserve material. Spring growth does not completely exhaust the reserve; growth after a cutting entails a greater drain. After spring growth in the second year the reserve soon mounts up again. Cutting doubtless influences the specific weight, but this returns to normal when the final cutting is not made too near the beginning of winter. The specific weight of the root increases up to a certain degree, after which a decline follows. In these studies the maximum was attained in the first year in cultivated red clover, in the second to third year in meadow red clover, and in the third year in alfalfa.

**Alfalfa in Connecticut**, B. A. BROWN and W. L. SLATE, JR. (*Connecticut Storrs Sta. Bul.* 115 (1923), pp. 301-323).—Experiments with alfalfa carried on since 1914 included strain tests as to yield and hardiness, soil treatments, and methods of seeding.

Grimm was the hardiest of the strains tested, and northern-grown common gave better results than Kansas grown, equaling the variegated or selected strains. Turkestan yielded consistently less than Grimm, common, and the selections. Arabian failed to survive the first winter, and Peruvian and Provence were inferior in hardiness and low in yields.

Alfalfa responded to very large applications of lime. However, no attempts to grow alfalfa were made without lime. Manure produced good crops of alfalfa, but not so cheaply as acid phosphate and potash, and grasses and weeds were more evident on the manured plats. Neither acid phosphate nor basic slag alone increased the yields of alfalfa appreciably, and acid phosphate and manure did not surpass manure alone. Potassium chlorid alone or with acid phosphate resulted in less winterkilling and enhanced yields. Complete fertilizers produced good crops, but acid phosphate and potash were more economical.

Late summer seedings of alfalfa alone were complete failures in four out of seven cases. Admixture of grass seed with alfalfa returned smaller yields than the seedings of pure alfalfa, but seemed to insure against complete crop failure. The grasses tend to crowd out the alfalfa. Seeding alfalfa in April with early maturing oats or barley resulted in fair stands, but very little alfalfa was obtained when seeded with late maturing oats. Both methods were superior to seeding alone in August on the same field. The rate at which the oats or barley was seeded had little influence on the stands of alfalfa. Much less seed was needed when drilled than when broadcasted, and 10 lbs. of drilled seed per acre gave nearly as good results as 18 lbs. drilled.

[**Red clover and rainfall at Svalöf, 1908-21**], H. WITTE (*Sveriges Utsädesför. Tidskr.*, 33 (1923), No. 3, pp. 160-182, figs. 3).—The yields of Swedish red clover and Silesian clover, obtained in comparative tests at Svalöf from 1908-21 inclusive, are reported in tabular form and discussed. Tables are also given to point out the influence of the quantity and distribution of the rainfall on the yields for the different years.

The results showed that Swedish red clover the first year yielded only 8 per cent more hay than was secured from Silesian clover, but the second year the yield of Swedish red clover was more than double that of the Silesian. The Swedish red clover produced 85 per cent of its total yield in the first cutting and the Silesian 60 per cent. It is estimated that on the average the Swedish



red clover, as compared with the Silesian, yields 50 per cent more hay, although the second growth of the Silesian attains more than twice the height of the second growth of the other variety.

The amount of precipitation was found to be of the greatest importance for the development of the first as well as of the second crop. When the amount of precipitation during spring and early summer was small, the Silesian clover matured two to three weeks earlier than the Swedish red clover and was, therefore, more subject to dry weather conditions, the latter variety often being benefited by the rains falling between the time of cutting the two varieties.

**Flax stem anatomy in relation to retting**, R. L. DAVIS (*U. S. Dept. Agr. Bul. 1185 (1923), pp. 27, figs. 23*).—The retting objective and factors that may interfere are discussed, the progress of retting in the different tissues of the stem is traced, some macroscopic and external changes in the flax stem during retting are described, and mechanical methods of testing wet flax stems for the completion of retting are analyzed and compared. The desirability of stems of uniform diameter and fiber quality is emphasized.

Retting proceeds from the cambium layer toward the outside of the stem. The cuticle and the leaf scars form a waterproof covering for the entire exterior of the stem except the stomata. The order in which the cortical tissues are retted depends upon their proximity to the cambium layer as well as on the solubility and thickness of the pectin layers in the different tissues. Changes in the flax stem, visible and most closely associated with the completion of retting, are disintegration of the leaf scars, the mechanical separation of the cuticle, and the separation of the fiber bundles from the rest of the cortex.

The mechanical test on wet flax stems, made by pulling the girth of cortex away from the wooden core at right angles to the stem and starting near the root end, is easily made by inexperienced workers, because the resistance to separation at the nodes is marked. This type of leaf-scar test is said to be more dependable than the loose-core test now in common use. The dependability of the leaf-scar test may be increased by supplementing it with the epidermis test, wherein the loosened cortex is moved to and fro in clear water in order to observe whether the cuticle is thoroughly loosened and the fibers are sufficiently divided.

**Determination of the fiber content in bast fiber plants in breeding work**, G. BREDEMANN (*Faserforschung, 2 (1922), No. 4, pp. 239-258*).—A method for estimating the fiber content of plants such as hemp, flax, and nettle and designed primarily for the comparison of pure lines in breeding experiments gave very satisfactory results. Essentially, the stalks are digested in a solution of sodium hydroxid of 2.5° B., the fiber and outside tissue removed from the wood, the epidermis and parenchyma separated by careful agitation in warm water, and the resultant material sorted on a wire sieve. The process is repeated, employing sodium hydroxid solution of 1.5° strength.

**Seed potato investigations**, H. O. WERNER and R. F. HOWARD (*Nebraska Sta. Research Bul. 24 (1923), pp. 58, figs. 23*).—Soil and climatic conditions in the high altitude region of western Nebraska (E. S. R., 48, p. 336) are considered suitable for the production and perpetuation of high yielding seed potatoes. When planted in comparative trials, seed stocks produced on dry land at the highest altitude excelled in point of quality and yield of tubers.

Tuber line studies with numerous lots of different varieties revealed early and late maturing strains, as well as a type of degeneracy very similar to or identical with spindling tuber described by Folsom on page 350. This degeneracy manifests itself by a stiff, upright habit of growth and by an elongation of the tubers. Affected strains never recover but become progressively weaker.



The degeneracy most common in western Nebraska, which has been studied in 10 different varieties, is perpetuated through the tubers and appears to be transmitted from plant to plant in the field. Irrigation produces conditions more conducive to the rapid increase of this degeneracy than dry land culture, the percentage of degeneracy increasing and the yield decreasing with each additional year of irrigation. This type of degeneracy causes very serious decrease in tuber yields, until eventually no marketable tubers are produced. Many lots from isolated fields in the newer dry land potato-growing sections are relatively free from this degeneracy.

**Report on potato maturity and yield trials, 1921 and 1922, W. H. PARKER** (*Jour. Natl. Inst. Agr. Bot.*, No. 1 (1922), pp. 5-19).—The comparative yields and maturities of nine British potato varieties from different districts in Great Britain are tabulated and discussed. It is concluded that "the district from which seed tubers are obtained apparently does not affect the yield or maturity of a variety directly, but only in so far as the district may be favorable or otherwise to infection of the seed with virus disease."

**Report of the potato synonym committee on potatoes sent for immunity trials to the potato testing station, Ormskirk, Lancashire, 1922, R. N. SALAMAN ET AL.** (*Jour. Natl. Inst. Agr. Bot.*, No. 1 (1922), pp. 36-44).—The results of examinations of 241 varieties are reported, with notes on the presence of wart disease.

**Report of experimental work and field observations in investigating and factors affecting the sugar content and purity of sugar beets, seasons 1921 and 1922, A. W. SKUDERNA and C. E. MICKEL** ([*Rocky Ford, Colo.*]: Amer. Beet Sugar Co., [1922], pp. 119, pl. 1, figs. 46; [1923], pp. 90, pls. 17, figs. 3).—These mimeographed reports of experiments with sugar beets in the Arkansas Valley of Colorado include the results of time of plowing and planting trials; rotations; rates of thinning; studies of beet root development; soil nitrate determinations; nitrification experiments; analyses of water from irrigation canals; meteorological data; sulphur, fertilizer, and variety trials; selection and improvement work; seed production experiments; observations on the prevalence of leaf spot and minor diseases in the region, and studies of control methods for leaf spot; the effects of defoliation; notes on insect pests of 1921 and 1922; data on the life history of the sugar beet webworm (*Loxostege sticticalis*); a survey of areas infested with the sugar beet nematode; determinations of field losses before and after topping; shrinkage in field silos; estimations of the peak in sugar content; and irrigation and seed treatment experiments. Some of the investigations were made in cooperation with the Colorado Experiment Station and the U. S. Department of Agriculture.

**Critical periods in the growth of the sugar crop, M. KOENIG** (*Mauritius Dept. Agr., Gen. Ser., Bul.* 27 (1922), Eng. ed., pp. 16).—Comparison of yields of sugar cane and climatic data at Mauritius revealed the existence of critical periods in regard to rainfall in July and in November, and as concerns temperature, in March.

**The sweet potato (*Ipomoea batatas*), G. B. BROOKS** (*Queensland Agr. Jour.*, 20 (1923), No. 2, pp. 124-148, pls. 10, figs. 6).—About 50 varieties of sweet potatoes are described, and are classified according to a key based on shape and size of leaf; length, color, and size of stem; presence of star; color of lower surface of veins; pubescence; color of tuber and of flesh; distinctness of wood elements in tuber; maturity; yield; culinary qualities; and habit of growth of tubers. Analyses of 41 varieties are tabulated, and typical leaves, tubers, and tuber cross sections are illustrated in color. The propagation of new varieties from seed is discussed briefly.



**Harvesting and storing sweet potatoes**, J. C. C. PRICE (*Alabama Sta. Bul.* 220 (1923), pp. 14, figs. 6).—Harvesting and storage experiments with sweet potatoes are reported on, supplementing previous work (E. S. R., 38, p. 136). The excellent keeping results obtained in the earlier studies appear to have been largely due to the fact that sweet potatoes were dug before vines were frosted and then stored and cured properly in a house.

Triumph and Porto Rico sweet potatoes dug before frost and either banked or stored in houses suffered comparatively slight losses during storage from fall till spring, whereas those dug after frost lost from 50 to around 90 per cent. These and other observations show that the ultimate loss in culinary value, keeping, and germination is increased in proportion to the delay in harvesting after the vines are frosted. Vines may be removed a few days before harvest without causing depreciation in either culinary or keeping qualities. Lack of curing may cause discoloration without spoiling the product for food. Properly harvested and well-cured sweet potatoes will withstand, without damage, a lower temperature than uncured sweet potatoes. Sweet potatoes dug before frost and properly cured do not seem to need much ventilation in a wooden house. Sweet potatoes stored in houses lost an average of 11.83 per cent and in banks 5.53 per cent. Temperatures taken at different levels in the room during curing gave indications that if sweet potatoes are dug and placed in the storage house during curing, each bin should be filled gradually rather than at one time, in order to prevent overcuring near the ceiling.

**Improvement of Kubanka durum wheat by pure-line selection**, R. W. SMITH, L. R. WALDRON, and J. A. CLARK (*U. S. Dept. Agr. Bul.* 1192 (1923), pp. 15, figs. 4).—The origin, adaptation, comparative yields, and other characteristics of Kubanka are discussed, together with an account of the improvement of the variety by the pure-line selection method in cooperation with the North Dakota Experiment Station at the Dickinson Substation. Kubanka has been compared elsewhere (E. S. R., 44, p. 141) with the other durums.

Nodak durum wheat (Kubanka No. 98), which seems to be the most promising of the 143 pure-line selections of Kubanka considered, combines high yielding ability with rust resistance and good quality for the making of macaroni. It is an amber durum of the Kubanka type, but has heads slightly longer than the average for that variety. It also differs from the original Kubanka in being more resistant to stem rust.

**The wheats of southeastern Russia from the point of view of milling and baking**, K. M. CHINGO-CHINGAS (*Trudy Prikl. Bot. i Selekt. (Bul. Appl. Bot. and Plant Breeding)*, 13 (1922), Sup. 24, pp. 55, pl. 1, figs. 4).—Milling and baking tests were made upon 3 soft winter varieties of common wheat, spring varieties including 5 durum, 13 common, and Persian Black (*Triticum persicum*), and *T. dicoccum*, from the Governments of Saratov and Samara. A stone mill was employed.

Some of the varieties were ground easily and quickly, whereas several subsequent breaks were required to free the bran of others from all mealy substances. *T. vulgare lutescens* × *T. vulgare graecum*, and Persian Black were hard to break, and *T. vulgare hostianum*, *T. vulgare lutescens*, *T. durum melanopus*, and *T. durum coerulescens* were easy to mill.

The varieties could be grouped as producing highly granulated, intermediate, and weak mealy flours. All durum wheats and a few hard common wheats yielded granulated flour, and weak flour was obtained exclusively from soft common wheats, but no relation whatever was observed between ease of milling and granular character of flour. Two color groups were distinguished,



one yielding yellow flour and the other white, ranging from snow to a brownish tint. Variation was also seen in the intensity of the yellow color. With 2.5 per cent of ash in the dry matter as a basis, the large kernels of *T. durum hordeiforme* No. 432 yielded 86 per cent of flour, medium kernels 75, and small kernels 46 per cent.

From 100 gm. of flour, varieties yielding granulated flour produced 160 gm. of dough, intermediate 160, and weak flour 152; weight of loaf 143, 141, and 134 gm.; and volume of loaf 361, 380, and 401 cc., respectively. The greatest loaf volume and the most dough were produced by *T. durum melanopus* from Samara Government (Bezenchouk), and the largest loaf, 499 cc., was secured from *T. vulgare* v. *hostianum*. Blends of durum with soft winter wheat and with Persian Black were satisfactory in baking quality. The texture varied greatly among the varieties tested. The hard wheat (durum) showed fine porous structure with thin walls. The bread from the soft wheats had coarser air cells but, even among varieties akin to durum wheats in their porous structure, had a certain coarseness common in rye bread. The shape of the loaf and the elasticity of dough at proving and baking varied greatly in the different wheats, with the durums and Persian Black retaining the shape especially well. Flour from the winter wheats was not of great baking strength, and the loaves baked from it were rather formless. The worst in this respect was *T. dicoccum*, which yielded low formless loaves with a coarse cracked crust. Bread from durum flour had a pleasant flavor, did not grow stale as soon as that from soft wheats, and the crust did not dry so easily.

**Investigations with wild rice seed**, C. W. LEGGATT (*Seed World*, 14 (1923), No. 5, pp. 20, 21, figs. 4).—Results at the Department of Agriculture at Ottawa, Canada, indicate that a satisfactory germination test can be obtained with wild rice (*Zizania aquatica*) seed if the sample is so packed as to remain thoroughly wet in transit. For best results in testing, the seed should be sown in mud of a depth of about 2 in. and submerged. The test dish need not be more than 3 or 4 in. deep, but should be from 4 to 6 in. in diameter to accommodate 50 seeds. The test should be carried out at a temperature of from 18 to 20° C. (64.4 to 68° F.). Total germinations ranged from 46 per cent between cloth at 20–30° to 80 per cent in mud at 19.5–22°. Practical information is given regarding the commercial storage and shipping of wild rice seed.

**Agricultural seed inspection**, A. S. LUTMAN (*Vermont Sta. Bul.* 233 (1923), pp. 8).—The purity guaranty, percentage of germination, and number of weed seed per pound are tabulated for 188 samples of agricultural seed obtained from local dealers in the State during April, 1923.

[**Report of the Official Seed Testing Station for England and Wales, 1922**], C. B. SAUNDERS (*Jour. Natl. Inst. Agr. Bot.*, No. 1 (1922), pp. 24–35, fig. 1).—The average purity and germination are tabulated for 25,822 samples of seed received in the year ended July 31, 1922. Besides discussion of the data secured, a course of training in seed testing is outlined.

**Methods of seed analysis**, C. B. SAUNDERS (*Cambridge, Eng.: Natl. Inst. Agr. Bot.*, 1923, pp. 15).—The methods used at the Official Seed Testing Station for England and Wales are outlined for independent analysts.

[**Seed and weed control in Wisconsin, 1920–22**], A. L. STONE (*Wis. Dept. Agr. Bul.* 52 (1922), pp. 136–156, figs. 9).—The activities of the seed and weed control division of the Wisconsin State Department of Agriculture are reported for the biennium ended June 30, 1922. Analyses of 8,668 samples of seed were made in the period.

**Weed control in meadows and pastures through suitable fertilizer treatment**, O. NORTE (*Bl. Gutsreform*, 183 (1922); *abs. in Ztschr. Pflanzenenähr. u. Düngung*, 2 (1923), No. 6, *Wirtschaft.-Prakt.*, pp. 326, 327).—During a compari-



son of nitrogenous fertilizers, the author observed that on plats receiving ammonium sulphate, ammonium sulphate-nitrate, and ammonium chlorid (physiologically acid fertilizers), dandelions were greatly invigorated, whereas where sodium nitrate, sodium ammonium nitrate, or potassium ammonium nitrate (physiologically basic fertilizers) was applied, dandelions were decidedly depressed. The same plats received no fertilizer the second year, but presented a similar appearance. Only scattering plants of dandelion and sorrel were noted on the plat receiving potassium ammonium nitrate.

## HORTICULTURE.

**Report of the division of horticulture, W. T. MACOUN** (*Canada Expt. Farms, Div. Hort. Rpt. 1922, pp. 42, figs. 13*).—A general report (E. S. R., 48, p. 37), in which are discussed fruit-breeding operations and miscellaneous varietal and cultural tests carried on during the year.

Observations upon seedlings of *Pyrus baccata* × *P. malus* and the reciprocal cross indicated that the *P. baccata* parent is not only homozygous but also dominant for practically all its characters, thus rendering efforts to secure a desirable combination exceedingly difficult. Observations upon the stolon producing habit of seedling autumn-fruiting strawberries indicated a marked difference in the tendency to form runners, many being almost barren, while one individual produced 25 plants during a single season. Attempts to breed a thornless gooseberry with desirable fruit were unsuccessful, the thornless character being apparently recessive. Results of self-compatibility tests with apple varieties, set forth in detail, indicate a preponderance of sterility, only four varieties, Oldenburg (Duchess), Scott Winter, Livland Raspberry, and Antonovka, being found almost completely self-fertile.

In a test of four systems of grape pruning, namely, upright arm, fan, Kniffin and horizontal arm, the highest yield was secured from the first named, but because of the fact that most grapes have to be laid down and covered during the winter, the fan system is considered the most adaptable. Tabulated data are given on the yield and hardiness of a large number of grape varieties. Of 30-odd tomato varieties and strains tested for yield and time of ripening, the variety Alacrity, developed at the station, led in production of early ripe fruit. In tests of sweet corn varieties, Pickaninny, Early Malcolm, and Sweet Squaw varieties originated at the experimental farm, averaged 64, 70, and 72 days, respectively, to attain maturity. The application of Bordeaux dust to the sand floor of a storage cellar and later to the plants themselves greatly increased the percentage of celery and cabbage plants surviving the winter storage season.

[**Horticultural investigations at the Summerland, B. C., Experimental Station**], R. H. HELMER (*Canada Expt. Farms, Summerland (B. C.) Sta. Rpt. Supt. 1922, pp. 7-67, figs. 4*).—Soil management studies conducted with a view to determining the most economical method of developing young orchards indicated that of the six methods employed, namely, (1) clean cultivation, (2) alfalfa sod mulch, (3) soiling crops and hairy vetch, (4) red clover and alfalfa sod mulch, (5) truck crops with manure, and (6) farm rotations, the third was most satisfactory taking into consideration both yield and growth. In 1922, the seventh growing season, the trees under this treatment averaged 66.7 lbs. of fruit, this being 21.6 lbs. greater than that of any other treatment. Contrary to expectation, treatment No. 4 yielded very poor results, the clover and alfalfa competing so seriously for water as to permanently weaken the tree. Yield and growth data for the experiment are presented in tabular form.



Records are given of the yield and keeping quality of a large number of commercial and recently named seedling apples. A test of manure with and without the addition of nitrate of soda upon Winesap trees planted in 1916 gave no significant results, the manure alone being as satisfactory to date as any other treatment.

Rochester and Muir peaches showed considerable promise. Seedlings obtained by crossing the Persian and black walnut yielded thin-shelled, good quality nuts.

A quantitative thinning test with apples led to the conclusion that the amount of thinning should be based on the age and vigor of the tree, since young vigorous trees are able to mature more fruit per unit of branch than are old or weakened individuals. Thinning work with apricots, peaches, and plums indicated that these fruits require thinning. Examination of the spur performance in a year following various fruit thinning treatments suggested that heavy thinning alone can not induce annual fruiting, soil moisture and plant food supply being deemed of greater importance.

A study of the relation of time of picking and the keeping life of apples is reported in some detail, and led to the observation that, because of seasonal fluctuations, several years will be needed to formulate any definite conclusions. Data are also presented on the keeping quality of apples grown under different systems of soil management. Measurements of apples on the tree showed that summer and autumn varieties enlarge right up to the time they drop, while winter fruits continue to grow as late as November 1. Irrigation studies with the apple indicated the importance of maintaining a uniform moisture supply in the soil, especially during the period of fruit setting. Fall irrigation was beneficial only when the water supply in the soil was below normal.

Tomato fertilizer studies showed a response to manure and nitrate of soda, with little or no influence from potash or phosphoric acid. Irrigation studies with vegetables showed that a moderate quantity of water was generally most satisfactory, large quantities delaying maturity in certain vegetables and in the case of the tomato causing an increased amount of fruit cracking. Water apparently decreased blossom end rot in the tomato. Brief notes are given on cultural and varietal tests with various vegetables.

**The study of bearing habit of apple varieties,** W. B. MACK (*Amer. Soc. Hort. Sci. Proc.*, 19 (1922), pp. 163-173, figs. 10).—Observations and measurements taken on approximately 40,000 growing points on 36 apple trees composed of standard and crab varieties indicated no definable varietal peculiarities other than those which may be seen by casual examinations. Wealthy and York spurs came into bearing younger than those of most of the varieties studied. In varying degrees all varieties produced part of their fruit on axillary buds along terminal growths. Differences were noted in the length of spur growth between varieties. However, these differences were no greater than those between individual trees of a single variety, or even between separate branches on a tree.

It was observed that in biennial fruiting mature trees of Wealthy, Baldwin, and Oldenburg a large part of the crop of the on year was habitually borne on terminal growths and on spurs on younger wood, while in the off year the crop was carried largely on spurs on older wood located near the larger branches. Young trees showing a biennial tendency bore a large part of their off-year fruit on long growths and late second growths. Biennial trees in the off year had made greater average growths during the previous season than those in the on year. Nitrogen favored bearing on terminal growths and young spurs and on successively blooming spurs in the off year. Pruning had no effect on bear-



ing habit. As a general deduction, the author interprets his observations in the light of the carbohydrate nitrogen ratio.

**Varietal differences in growth of one-year apple trees,** A. P. FRENCH (*Amer. Soc. Hort. Sci. Proc.*, 19 (1922), pp. 183-187).—Measurements taken over a period of years upon 1-year-old apple trees of several varieties grown in a commercial nursery at Westfield, Mass., showed that varieties differ considerably from year to year in the interrelations between height, diameter, and internode length. The length of internodes was found to be more constant than the height or trunk diameter. The relation between height and diameter and height and internodes was approximately the same, while diameter and internodes showed practically no relation. The index of stockiness, obtained by dividing height by diameter, was found to vary from year to year in a single variety and also between varieties in the same year. A comparison of leaf area and volume of wood showed that, with the exception of Tompkins King and Baldwin, an increased wood volume was associated with an increased leaf area. Finding the loss in dry weight of a sample of leaf tissue of Baldwin following the covering of the same with black paper to be much less than that obtained for Yellow Transparent leaves, the author concludes that varieties differ in the amount of starch accumulated during clear and cloudy weather, and suggests that this difference may account for the variation in the ultimate size of trees.

**Pruning young apple trees,** F. P. CULLINAN and C. E. BAKER (*Indiana Sta. Bul.* 274 (1923), pp. 40, figs. 13).—Pruning investigations carried on at Laurel, Bedford, and LaFayette with apple trees from the time of planting to initial fruiting indicated conclusively that pruning of the young tree tends not only to dwarf the tree but also to retard the initial fruiting.

At LaFayette, data were recorded at the end of each year upon carefully selected Grimes trees submitted to nine pruning treatments varying from none to severe top and root pruning. Of that lot of trees receiving severe root pruning and no top pruning at the time of planting, 70 per cent died during the first season. On the other hand, trees receiving heavy root and top pruning showed satisfactory survival, but were lightest of any of the lots at the end of the first season in respect to total weight. Despite the fact that new growth was much less in unpruned than in pruned trees, the former showed the greatest gain in circumference of trunk and in total weight. Unpruned trees were 25 per cent larger in growth at the end of the sixth season than were trees receiving annual cutting back. Heading back during the first three years reduced root growth 41 per cent below that of unpruned trees. Counts made during the third and fifth years showed twice as many leaves on unpruned trees as on those which had been headed back and thinned each year. Pruning of a single branch resulted in the dwarfing of that branch as compared with adjacent branches. In the spring of 1921 bloom was very abundant on all unpruned trees, fairly so on lightly pruned, and very scattering on severely pruned trees.

Comparable results were secured in the Bedford experiment, where Winesap and Grimes trees growing both in grass and in tillage were pruned to open head, central leader, and natural form. A varietal distinction was noted, in that Winesap was dwarfed more by pruning than was Grimes. The deleterious effect of sod was shown in the fact that trees in sod were dwarfed more than those receiving any of the pruning treatments. At Laurel, lightly pruned Grimes trees bore much more fruit during the period 1915-1921 than did more severely pruned trees.

In general conclusion, the authors point out that some pruning is necessary in the early life of an apple tree in order to determine the proper distribu-



tion of branches and to restrain one-sided or excessive growth. The variety should be taken into consideration, as, for example, the Grimes needs little more than judicious thinning, while Winesap, Delicious, and other strong growers may require somewhat severe treatment.

**Concerning the status of the apple industry in the region east of Mount Etna,** G. SAVASTANO (*Nuovi Ann. [Italy] Min. Agr.*, 3 (1923), No. 1, pp. 20-26).—A general discussion relating to the geographical distribution, soils, planting distances, methods of propagation, culture, varieties, insect and fungus pests, etc.

**Sterility of strawberries; strawberry breeding,** M. B. CUMMINGS and E. W. JENKINS (*Vermont Sta. Bul.* 232 (1923), pp. 3-61, pls. 2, figs. 6).—This is a report upon extended studies of sex relation in the strawberry, a fruit which manifests nearly all degrees of sexual vitality from that of absolute sterility to complete fertility. Attempts to influence the sex of cultivated strawberries by modifying nutrient conditions both in the soil and in the air failed, the only result being a change in the number of blossoms per plant. Extremes in soil texture, namely sand and clay, reduced and an increase in CO<sub>2</sub> content of air increased the average number of blossoms, but had no significant effect on the stamens or their pollen content.

Research into the history of cultivated strawberries revealed that nearly all the imperfect varieties whose histories are known have partially imperfect ancestry. Furthermore, imperfect varieties have given rise to a large proportion of imperfect progeny.

Breeding experiments conducted over a period of years with a view to studying the inheritance of sex when perfect and imperfect varieties are crossed indicated that the sexual nature of the strawberry is hereditary, since in open and self-pollination studies with perfect varieties the progeny were nearly all perfect, while open-pollinated imperfects (Cardinal, Haverland, Warfield) yielded progeny 45 per cent of which resembled the ovule parents. Crosses between perfect and imperfect forms yielded in the F<sub>1</sub> generation approximately equal numbers of perfect and imperfect offspring. Back crosses of some of the imperfect progeny with their perfect parents resulted in about equal proportions of imperfect and perfect forms.

Studies of the inheritance of various fruit characters indicated segregation of separate factors among the progeny. Some degree of blending occurred in respect to quality, yet some good quality seedlings were obtained from poor parents. Much segregation was noted in respect to shape of berries. In the ripening season there was a strong tendency to intermediacy. In respect to runner formation, seedlings were inclined to resemble their parents. Shades of flesh color in progeny were much like those of the parents. Segregation into many classes occurred in respect to flavor. However, when sweet and acid berries were crossed approximately equal numbers of the progeny resembled each parent.

As a result of the studies the authors conclude that not only can the dissociated sexes in the strawberry be brought together, but also a segregation of united sexes can be effected. It is believed that the cause of sterility in the strawberry lies in its mixed genetic constitution, probably the result of hybridity among ancestral forms. Hence the results of the experiment may not be applicable to other fruit species whose history is dissimilar.

**Avocado culture in California,** K. RYERSON, M. E. JAFFA, and H. GOSS (*California Sta. Bul.* 365 (1923), pp. 571-638, figs. 19).—This bulletin is prepared in two parts, the first of which, general in nature and comprising the major part of the paper, is entitled History, Culture, Varieties, and Marketing, by



Ryerson (pp. 575-629), and deals with history, botany, cultural requisites, propagation, varieties, marketing, etc. The second part, entitled *The Nutritive Value of the Avocado*, by Jaffa and Goss (pp. 630-638), presents the results of 110 analyses, representing 68 varieties. The average total dry matter in the edible portion of mature fruits was 29.44 per cent, much higher than in any other fruit with the exception of the banana, which approximates 25 per cent. The protein content averaged higher than in other fruits, attaining in one variety, Bartley, a maximum of 4.39 per cent. In respect to carbohydrates, the avocado was low as compared with other fruits. The mineral content, averaging 1.32 per cent, was approximately twice as high as that in any other species. The chief nutrient value of the avocado is said to lie in the fat content, which in the varieties studied ranged from 9.78 to 31.6 per cent, with an average of 20.6. Information is presented concerning the caloric value, digestibility, vitamin content, and dietetic value of the fruit.

**Cacao**, B. E. DAHLGREN (*Field Mus. Nat. Hist. [Chicago], Dept. Bot. Leaflet 4* (1923), pp. 14, pls. 2, figs. 3).—A popular account concerning the origin, early use, and flowering habit of cacao.

**The grafting of the walnut**, L. KREITMANN (*Rev. Eaux et Forêts*, 61 (1923), No. 12, pp. 539-546, pls. 3).—This is an illustrated article dealing with the asexual propagation of the Persian walnut in France, discussing stocks, varietal peculiarities in the stock to scion relation, and various grafting methods.

## FORESTRY.

**Studies in tolerance of New England forest trees.—IV, Minimum light requirement referred to a definite standard**, G. P. BURNS (*Vermont Sta. Bul.* 235 (1923), pp. 3-32, pls. 4, figs. 14).—In this, the fourth contribution to the general subject (*E. S. R.*, 36, p. 242), the author reports in considerable detail upon a study undertaken to determine the comparative light requirements of forest trees. Under constant soil moisture, air temperature, and air moisture conditions, pot-grown trees and, in some cases, excised branches were inclosed in sealed jars containing a known quantity of  $\text{CO}_2$  and submitted for a period of three hours to different light intensities obtained by regulating the distance of the plant from Nela Trutint lamps and recorded by means of a vacuum thermocouple. The influence of the light on the plant processes was determined by the gain or loss in  $\text{CO}_2$  in the jar, a gain signifying a decrease and a loss an increase in organic material in the plant. The point where the respiration photosynthesis coefficient equaled one is taken as the approximate minimum light requirement of the plant. Figures based on that individual tree of each species which maintained a coefficient of one in the light of the lowest intensity gives the following relative minimum light requirements for the species studied: Bull pine 306, Scotch pine 287, white cedar 186, tamarack 176, Douglas fir 136, lodgepole pine 136, red oak 133, hackberry 115, Englemann spruce 106, white pine 104, Norway spruce 87, hemlock 84, beech 75, and sugar maple 34.

In conclusion the author points out that the work is of a preliminary nature, but for the first time refers light requirements to a definite measurable standard.

**Preliminary experiments on the germination of conifer seeds**, H. I. A. GRAY (*Roy. Scot. Arbor. Soc. Trans.*, 37 (1923), pt. 1, pp. 22-25).—In studying the effect of several treatments, including hot and cold water and aqueous solutions of iodine and calcium chlorid, upon the germination of coniferous seeds, the author found a slight tendency for increased germination following treatment with calcium chlorid, iodine, and cold water. A decreased germination was obtained with water heated to 122° F., and seeds dipped for 2 minutes in

boiling water were apparently killed. In a repetition of the test, seeds were injured when the boiling water treatment was limited to 15 seconds. Treatment with acetic acid also appeared to be actually harmful. The rolling of seeds in red lead had no injurious effect.

**A handbook of Coniferae, including Ginkgoaceae**, W. DALLIMORE and A. B. JACKSON (*New York: Longmans, Green & Co.; London: Edward Arnold & Co., 1923, pp. XI+570, pls. 32, figs. 120*).—An exhaustive treatise on the conifers, in which an endeavor has been made to include all the known species which have been cultivated or grow wild in the British Isles.

**White pine; white spruce; Douglas fir; hemlock** (*Canada Dept. Int., Forestry Branch Tree Pamphlets 1 (1923), pp. 8, figs. 4; 2, pp. 7, figs. 3; 3, pp. 8, figs. 3; 4, pp. 6, figs. 3*).—These are brief pamphlets treating of the geographical distribution, importance in the lumber industry, habits and forms of the trees, and methods of natural and artificial reproduction.

**Notes on the structure of wood**, M. B. WELCH (*Tech. Gaz. N. S. Wales, 13 (1923), No. 2, pp. 105-113, figs. 8*).—Following a preliminary discussion of the structure of the wood of forest trees in general, the author points out peculiar anatomical features in various Australian species and explains the relation of such structures to the strength and character of the wood.

**The American lumber industry**, N. C. BROWN (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1923, pp. XVIII+279, pl. 1, figs. 38*).—This book, the introduction of which is by W. B. Greeley, discusses in a comprehensive manner the resources, production, distribution, and utilization of lumber in the United States.

**The forests of Canada: Their extent, character, ownership, management, products, and probable future** (*Ottawa: Canada Dept. Int., Forestry Branch, 1923, pp. 45*).—A general survey of the forestry situation in Canada, including such subjects as types of growth, producing regions, important species, forest ownership, legislation, administration, associations, educational and research facilities, annual increment, utilization of forest industries, etc.

**The Tree-planting Division [Canada]: Its history and work**, N. M. ROSS (*Ottawa: Canada Dept. Int., Forestry Branch, 1923, pp. 14, pls. 1, figs. 10*).—The experiences of several years have shown that with intelligent practices many species of trees and shrubs may be grown on the open prairies of western Canada despite the unfavorable climatic conditions. Suggestions are presented for the beautifying of homes by plantings.

**Planting in the national forests**, C. G. BATES (*Sci. Mo., 17 (1923), No. 6, pp. 609-616, figs. 6*).—A general article, in which the author reviews some of the accomplishments of the U. S. D. A. Forest Service during the 17 years of activity in planting trees on the national forest areas. One of the most conspicuous successes was that of establishing pine forests on the sand hills of central Nebraska, a region almost destitute of worth while vegetation.

**Annual report of the director of forestry of the Philippine Islands for the fiscal year ended December 21, 1922**, A. F. FISCHER (*Philippine Bur. Forestry, Ann. Rpt. Forestry, 1922, pp. 154*).—The usual detailed report (E. S. R., 48, p. 345) upon the activities of the various divisions of the Philippine Bureau of Forestry.

**Annual return of statistics relating to forest administration in British India for the year 1921-22** (*Brit. India Forest Admin. Statis., 1921-22, pp. 31, pl. 1*).—This is the usual report (E. S. R., 48, p. 345) concerning alterations in the area of forest lands, changes in boundaries, expenditures and revenues, and production during the year.



**Progress report of the forest administration in the Province of Assam for the year 1922-23**, W. R. LEG. JACOB and C. A. G. RIVAZ (*Assam Forest Admin. Rpt.*, 1922-23, pp. 15+47+2).—In a like manner to that of the preceding period (E. S. R., 48, p. 841), this presents information concerning the constitution and management of the State forests, general silvicultural operations, and financial records.

**Annual progress report of forest administration in the United Provinces for the period April 1, 1921, to March 31, 1922**, F. F. R. CHANNER (*United Provs. [India] Forest Admin. Ann. Rpt.*, 1921-22, pp. 36+LXXIII+3).—This is the usual annual report (E. S. R., 46, p. 645), devoted for the most part to statistical data on the area of forest lands, areas surveyed during the year, areas protected from fire, grazing, timber and other produce, expenditures, revenues, etc.

## DISEASES OF PLANTS.

**A Portuguese glossary of mycology and phytopathology**, E. RANGEL (*Arch. Escola Super. Agr. e Med. Vet. [Nichtheroy, Rio de Janeiro]*, 6 (1922), No. 1-2, pp. 57-105).—Two vocabularies are given, one of scientific Portuguese terms explained in the same language and one of Latin terms with Portuguese equivalents or explanations.

**Plant diseases of 1922 in western Quebec**, B. T. DICKSON (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 15 (1922-23), pp. 43-45).—Diseases of about 20 economic plants are very briefly noted.

**The Paris Plant Pathology Station, 1922**, P. MARCHAL (*Min. Agr. [France], Ann. Épiphyties*, 9 (1923), No. 1, pp. 70-72).—This brief report by the inspector general on research during 1922 in plant pathology gives special attention to potato degeneracy.

**Studies on immunity reactions in plants** (*Bol. Ist. Sierotera, Milan.*, 2 (1922), No. 5, pp. 261-274).—A tentative and introductory account is given by D. Carbone and a more detailed one by I. C. Vigliano on the presence in plants of certain substances supposedly related to disease resistance. It is not certain that in plants infection tends usually to initiate a reaction of resistance to disease. Various phases and results of the study are detailed.

**Studies on ultra-violet light, Röntgen rays, and radium used against plant diseases**, F. PICHLER and A. WÖBER (*Centbl. Bakt. [etc.]*, 2. Abt., 57 (1922), No. 14-17, pp. 319-327, fig. 1).—Smutted wheat was successfully treated with ultra-violet rays and Röntgen rays, but no favorable result was obtained from radium. A favorable effect was enhanced considerably by acidity in the medium, particularly in the presence of oxygen or oxygen-yielding substances. Röntgen rays are the more effective against infections internal to the grains.

**The toxic property of sulphur**, H. C. YOUNG (*Ann. Missouri Bot. Gard.*, 9 (1922), No. 4, pp. 403-435, figs. 4).—Examinations of research records, which are here listed, show that most of the evidence points to sulphur as being the toxic agent in cases of fungus control involving that element, and it is thought important to study the influence of the sulphur particle and molecule on the germination of spores.

It is stated that flowers of sulphur is not sufficiently toxic to inhibit the germination of spores of *Botrytis cinerea*, *Colletotrichum gossypii*, *Macrosporium sarcinaeforme*, and *Gloeosporium venetum* in closed-ring cells at ordinary temperatures. Spores of *Sclerotinia cinerea* and *Phomopsis sojae* were prevented from germinating.

Finely ground flowers of sulphur was more toxic than the unground flowers under the same conditions, but only at a H-ion concentration of pH 4-5.5.



Methods for the preparation of hydrophilic and hydrophobic colloidal sulphur have been devised. The former was extremely toxic to all the organisms tested; the latter slightly more toxic than the finely ground flowers of sulphur. The chemical and the fungicidal property of lime sulphur were studied.

The toxic property of sulphur, which is exhibited only when oxygen and water are present, is not due to  $\text{SO}_2$ ,  $\text{SO}_3$ ,  $\text{H}_2\text{S}$ , nor any of the common acids or oxids of sulphur, nor is it due to the sulphur particle. By chemical analysis the toxic property of sulphur has been found to be pentathionic acid, which is an oxidation compound formed from sulphur and water. This acid is volatile and is an active adsorption compound. It is destroyed in acid and alkaline solutions. Finely divided sulphur, which is more readily oxidized to pentathionic acid at ordinary temperatures than is flowers of sulphur, is said to have been used with excellent results as a spray in England, Australia, and Germany.

**Lime sulphur and calcium caseinate as a fungicide**, E. S. SALMON and E. HORTON (*Jour. Min. Agr. [Gt. Brit.]*, 28 (1922), No. 11, pp. 995-999).—In the carefully controlled experiments here briefly noted it has been found that lime sulphur at a strength of 1.003 sp. gr. (1 gal. of the concentrated wash (1.3 sp. gr.) to 99 parts of water), and containing 0.16 per cent of polysulphid sulphur, is lethal for the powdery conidial stage of the hop mildew, when the lime sulphur is used with calcium caseinate in order to secure complete wetting of the fungus. It is considered probable that lime sulphur at this strength and mixed with calcium caseinate will be found lethal for the American gooseberry mildew also (and other powdery mildews), and that at this dilution lime sulphur may be used on ripening dessert gooseberries without fear of disfiguring the fruit for market.

**The fungicidal properties of certain spray fluids, III**, E. HORTON and E. S. SALMON (*Jour. Agr. Sci. [England]*, 12 (1922), No. 3, pp. 269-279).—In continuation of the studies previously reported by Eyre, Salmon, and Wormald (*E. S. R.*, 44, p. 150), tests were made against the powdery conidial stage of *Sphaerotheca humuli* on young hop leaves in the greenhouse with the solutions indicated below:

Disodium arsenate containing 0.096 per cent  $\text{As}_2\text{O}_5$  proved fungicidal, killing also patches of leaf cells underlying the mildew patches, but not otherwise injuring the leaf. A solution containing 0.02 per cent  $\text{As}_2\text{O}_5$  proved fungicidal without killing any leaf cells. Trisodium arsenate containing 0.077 per cent  $\text{As}_2\text{O}_5$  proved fungicidal. Dicalcium arsenate containing 0.048 per cent  $\text{As}_2\text{O}_5$  proved fungicidal; when made up to 0.024 per cent  $\text{As}_2\text{O}_5$  the solution was apparently just fungicidal, but at 0.01 per cent  $\text{As}_2\text{O}_5$  it was practically nonfungicidal. Tricalcium arsenate containing 0.076 per cent  $\text{As}_2\text{O}_5$  was fungicidal; when it contained 0.02 per cent  $\text{As}_2\text{O}_5$  it possessed some fungicidal value, but practically none with 0.01 per cent.

Constituents of lime-sulphur wash proving nonfungicidal included calcium sulphate, sulphite, thiosulphate, and hydroxyhydrosulphid. Calcium polysulphid at 0.11 per cent proved fungicidal.

**Some notes on spray matters**, L. CAESAR (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 15 (1922-23), pp. 28-34).—These notes, which refer to both insects and fungi, deal with such matters as spraying currants to prevent defoliation, value of a casein-lime spreader, dry lime sulphur as a substitute for liquid lime sulphur, the comparative susceptibility of McIntosh and Fameuse apples to late attacks of scab, and the time for applying the first spray to apple trees.

**Combinations of dusting and spraying materials**, G. E. SANDERS (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 15 (1922-23), pp. 70-75).—The author sketches a few of the principal beneficial or injurious reactions that are shown to occur



on mixing several (chiefly well known) sprays or spray materials for fungicidal or insecticidal purposes.

**Studies on gummosis,** J. GROENEWEGE (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Alg. Proefsta. Landb., No. 12 (1922), pp. 79, pls. 16*).—An account is given of certain plant diseases in the Vorstenlanden, more particularly bacterial gummosis of certain economic plants, specifically peanut and tobacco, as affected by *Bacterium solanacearum* under observed or experimental conditions.

**Forms of Erysiphe cichoracearum,** S. BLUMER (*Centbl. Bakt. [etc.], 2. Abt., 57 (1922), No. 1-3, pp. 45-60, figs. 3*).—Data are recorded in detail as obtained from study of *E. cichoracearum* on a number of hosts named.

**Cultural characteristics of certain species of Fusarium,** T. G. MAJOR (*Quebec Soc. Protect. Plants, Ann. Rpt., 15 (1922-23), pp. 79-88*).—A limited study has been made of the reactions of several species of *Fusarium* found in root lesions when grown under various cultural conditions, for its bearing upon classification. Owing to the limited scope of the work, the conclusions are regarded as suggestive merely.

**Cycle of Ustilago hordei and U. avenae in vitro,** B. K. FLEROV (*Trudy 2. Vseross. Ent. Fitopat. Sezda, Petrograd, 1920, pp. 154-159*).—*U. hordei* and *U. avenae* may be easily cultured in a medium in which they pass through the whole cycle of their development, but they differ considerably between themselves. *U. hordei* is very sensitive to any change in the source of nitrogen, and spores are formed only when the medium contains the ammoniacal combinations. *U. avenae* develops spores in any nitrogen culture medium. The germination of the spores of *U. hordei* has been observed very rarely and only when the medium was slightly acidified by nitric acid. The germination of *U. avenae* was quite common and was observed in all media. The spores of *U. hordei* and *U. avenae* formed in a culture medium are larger and darker than the ones formed naturally and appear perfectly smooth. The spores of other fungi in the medium develop mycelium.

**Seed treatment for smut in cereals,** K. SAMPSON (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. C, No. 3 (1921-22), pp. 46-54*).—Wheat bunt, barley covered smut, and oat loose smut are among the more common and destructive diseases of cereals in Wales. Protective measures are discussed in connection with some costs and results.

Satisfactory control of wheat bunt and barley covered smut was obtained by the use of copper sulphate solution, formalin solution, and dry copper carbonate. A weak formalin solution, 1 pint to 40 gal. of water, gave complete control of loose smut of oats, the sprinkling method of application proving superior to the soaking method. A drawback to the formalin treatment is the necessity of sowing grain immediately after treatment, as the injurious effects on germination are shown to be cumulative. Very satisfactory results were obtained with dry copper carbonate. The method is easy to apply, gives satisfactory disease control, and does not injure germination or reduce yield. As to the question of costs, that per bushel for the copper carbonate treatment was 6d. as against ½d. for formalin and 1d. for copper sulphate. It has recently been shown, however, that equally good results may be obtained by the use of a mixture of anhydrous copper sulphate and calcium carbonate, and that this is considerably cheaper.

The experiments outlined indicate that more extensive trials should be made with dry chemicals for the treatment of seed wheat and barley. Similar experiments with oats are contemplated. The results also emphasize the necessity of obtaining yield data in connection with experiments involving the



treatment of grain or the spraying of crops whether it is desired to eliminate weeds or to control disease.

**Wheat seed treatment against stinking smut**, W. KRASSOWSKA and J. TRZEBIŃSKI (*Pam. Państw. Inst. Nauk. Gosp. Wiejsk. Pulawach (Mém. Inst. Natl. Polonais Econ. Rurale Pulawy)*, 1 (1921), A, No. 2, pp. 205-210).—Loss of germinability to a considerable extent followed steeping of seed wheat for 2 hours with  $\text{HgCl}_2$ ; Uspulun, formalin, soda, and  $\text{KMnO}_4$  caused but little injury. Treatment during 15 minutes caused much less injury. Germination was retarded by these preparations. Uspulun gave nearly disease-free plants even for the shorter immersion. Soda for 2 hours considerably reduced attack and for 15 minutes almost as much. Potassium permanganate did not reduce attack by stinking smut.

**Soil temperature as a factor affecting the pathogenicity of *Corticium vagum* on the pea and the bean**, B. L. RICHARDS (*Jour. Agr. Research [U. S.]*, 25 (1923), No. 11, pp. 431-450, pls. 2, figs. 6).—In previous publications (*E. S. R.*, 45, p. 543; 49, p. 347) the author described the effect of soil temperature on the pathogenicity of *C. vagum* on the potato. In the present paper the parasitism of the organism on the pea and the bean, together with observations on the reaction of the fungus to temperature, are described.

The investigations show that the fungus may become a vigorous parasite on the underground parts of both the pea and the bean, the severity of damage being conditioned by the temperature of the soil. *C. vagum* may produce lesions on the pea through a soil temperature range of from 9 to 29° C., the greatest damage resulting between 12 and 26°, with a definite optimum for tissue destruction at 18° (64.4° F.). Essentially these same temperature relations were found for the pathogenic action of the fungus on the bean. The temperature requirements for the pathogenic action of *C. vagum* on its hosts is believed to be definitely a fixed inheritable characteristic of the fungus which is more or less independent of the temperature relations of the host on which it becomes parasitic. The temperature range as indicated by the minimum and maximum temperatures for the pathogenicity of *C. vagum* is said to approximate closely the temperature range found for its saprophytic activities. The optima for these physiological processes, however, vary widely. No direct relation was found in the temperature requirements for maximum pathogenicity.

**Bacterial leaf spot of clovers**, L. R. JONES, M. M. WILLIAMSON, F. A. WOLF, and L. McCULLOCH (*Jour. Agr. Research [U. S.]*, 25 (1923), No. 12, pp. 471-490, pls. 6, figs. 3).—This is a joint paper giving the results of independent and cooperative investigations carried on at the experiment stations of Wisconsin and North Carolina and at the U. S. Department of Agriculture.

The disease was first noticed in Wisconsin in 1916, and the following year it was observed in North Carolina. While originally found on the red clover it has since been found on other species, the known hosts being *Trifolium pratense*, *T. medium*, *T. repens*, *T. repens latum*, *T. hybridum*, *T. incarnatum*, *T. alexandrinum*, and *T. pannonicum*. The disease is said to occur in Wisconsin, Iowa, Indiana, Virginia, Maryland, and North Carolina and is probably widely prevalent. All aboveground parts of the plant except the floral organs are known to be subject to attack. The spots may appear at any time throughout the growing season, and the lesions on the leaves at first are minute, translucent dots which enlarge and at length become irregular, blackish-brown areas. Mature leaves are perforated and frayed, due to the drying and falling of portions of the affected tissues. Under favorable moisture conditions a milky white bacterial exudate is formed on the lower leaf surface, and upon drying this becomes a delicate incrusting film.



With the type strain from Wisconsin, infection was secured only on the red clovers, but with the strains from North Carolina inoculations were made on the red, white, and alsike clovers.

Field observations are said to indicate that the disease is disseminated through the agency of rain or dew and of leaf-eating insects. It is considered probable that the organism may be disseminated with the seed and as a consequence form in new plants centers of infection.

The organism causing this disease is technically described as *Bacterium trifoliorum* n. sp.

**On the vitality of cotton seed**, G. F. LIPSCOMB and G. L. CORLEY (*Science*, 57 (1923), No. 1487, pp. 741, 742).—Attention is called to the fact that treating cotton seed with fungicides or with hot water has not proved practicable for the control of cotton anthracnose due to *Colletotrichum gossypii*.

An account of experiments is briefly given in which the authors report that the temperature which cotton seed can endure without affecting the vitality of the seed depends upon the amount of moisture present in the seed, whether heated in dry or moist atmosphere, and whether there is oxygen present during the process of heating. By thoroughly drying and heating cotton seed in a vacuum or any inert atmosphere, such as nitrogen, to prevent oxidation of the fats and proteins in the seed, a temperature of boiling water can be endured for several hours without affecting their vitality. The seed of one variety of cotton was subjected to a temperature of 100° C. for 26 hours without impairing vitality and with complete destruction of the anthracnose fungus. The seed so treated are said to have had a much higher percentage of germination than untreated seed.

**A bacterial disease of foxtail (*Chaetochloa lutescens*)**, H. R. ROSEN (*Ann. Missouri Bot. Gard.*, 9 (1922), No. 4, pp. 333–402, pls. 7, fig. 1).—In a previous note (*E. S. R.*, 40, p. 643) the author called attention to a disease of foxtail common in Arkansas. No concerted effort was made to discover the disease on other grasses, but artificial inoculations show that the pathogen is infectious on wheat, oats, rye, barley, corn, Sudan grass, millet, and perennial foxtail, a large number of cereal varieties being subject to attack. Artificial inoculations indicate that the organism may do serious damage, particularly to seedlings of oats and barley.

The disease appears to be different from any other known bacterial disease of grasses. Entrance to the host is gained by means of stomata and water pores. The organism, which is a single flagellate rod, white in culture, with colonies surrounded by a characteristic colorless area followed by a white precipitate on slightly acid media, is described as a new species, *Pseudomonas alboprecipitans*.

**Treatment of millet for smut**, W. KRASSOWSKA and J. TRZEBIŃSKI (*Pam. Państw. Inst. Nauk. Gosp. Wiejsk. Puławach (Mém. Inst. Natl. Polonais Écon. Rurale Puławy)*, 1 (1921), A, No. 2, pp. 211, 212).—Treatments with aqueous solutions applied to millet (*Panicum miliaceum*) seed infected with smut (*Ustilago panici milacei*) gave the best results with Uspulun, formalin, and corrosive sublimate. Potassium permanganate gave no defense against smut. Washing three times in pure water slightly diminished smut attack.

**Experiments on the control of onion smut**, T. WHITEHEAD (*Jour. Min. Agr. [Gt. Brit.]*, 28 (1921), No. 5, pp. 443–450).—Onion smut (*Urocystis cepulae*), first called to attention in England by Cotton in 1919 (*E. S. R.*, 42, p. 47), appears to be localized in a few centers, supposedly spreading but slightly, if at all; though in Northumberland (the original outbreak in which is described) a loss of 90 per cent of the crop may be expected in an unfavor-



able growing season. Experiments in control are outlined, in which it appears that the most effective treatment is formaldehyde, killing or, more likely, temporarily incapacitating the spores. The solution is fed into the drill in an open pipe sufficiently long to prevent splashing the liquid.

**Studies on the degeneracy in the potato at the Marle (Loire) Station, 1921.** C. PERRET (*Min. Agr. [France], Ann. Épiphyties*, 9 (1923), No. 1, pp. 61-69).—This review of potato pathology in connection with weather and other causes of loss gives attention also to causes and forms of degeneration in varieties, and to the improvement of local varieties and importation of others with regard to resistance.

**The immunity of potato varieties to *Phytophthora infestans* and *Rhizoctonia solani*.** M. S. UTKIN (*Trudy 2. Vseross. Ent. Fitopat. Sezda, Petrograd, 1920*, pp. 136-152).—The waste of potatoes in Russia from disease is estimated at about 300,000,000 bu. per year, the principal fungus disease being that due to *P. infestans*. Temperature and moisture are important factors in the production of infection by this fungus.

The results of the author's experiments showed no correlation between the resistance of leaves and that of tubers. In sandy soil the percentage of affected plants was considerably less than in a soil rich in organic matter. The thickness of the skin of potatoes had no apparent relation to the disposition to infection, though the structure of the outer layer was important in this respect. Close relation was noted between the disposition to infection and the structure of the leaves. Such varieties as Royal Kidney, Courier, and Siberian B. 222, having numerous hairs, which tend to keep water on the leaves, are readily infected.

Experiments were made also on the infection of potatoes by *R. solani*. No varieties showed immunity to this fungus, which infects also certain weeds. Variety No. 246 of the Agricultural Academy was found to be least affected, giving 97.2 per cent by weight of a normal crop. The least resistant variety was Grazia, giving 25.3 per cent of a normal crop.

**Spraying potatoes for blight in Berkshire** (*Jour. Min. Agr. [Gt. Brit.]*, 28 (1922), No. 11, pp. 1046, 1047).—An experiment carried on for nine years at the University College Farm, Reading, yielded results from which the conclusion is drawn that spraying has increased not only the total crop but also the percentage of sound salable tubers. The percentage of seed tubers by weight shows a slight reduction in the case of the sprayed plats, and there was a definite reduction in percentage occurrence. Spraying also reduced the percentage occurrence on the average of diseased tubers on all the plats and particularly in the late sprayed and the doubled sprayed plats.

**Potato leaf curl demonstrations.** A. D. COTTON (*Jour. Min. Agr. [Gt. Brit.]*, 28 (1922), No. 11, pp. 1019-1021).—With a view to showing practically the effect of potato leaf curl, the Ministry in 1921 established trials at the 12 advisory colleges or institutes situated in the 12 provinces into which the country is divided for agricultural purposes, the test variety selected being Arran Comrade produced from seed grown at Edinburgh.

The results show usually from leaf curl infected tubers (produced by plants only mildly attacked the previous season) only about one-half the yield obtained from normal seed tubers.

**Potato spindle tuber.** D. FOLSOM (*Maine Sta. Bul.* 312 (1923), pp. 21-44, pls. 4, figs. 2).—This is a nontechnical bulletin giving the results of investigations conducted jointly by the Maine Station and the U. S. Department of Agriculture (*E. S. R.*, 49, p. 247; 50, p. 46).



The author claims that spindle tuber is an important cause of poor tuber shape and of potato degeneration or running-out. The effects of the disease upon vines and tubers are generally alike in different varieties, but not exactly so. Spindle tuber is said to be perpetuated in the tubers and other juice-containing parts of the plant, without showing any effects until more or less time has elapsed after the original introduction of the cause of the disease. It has been found that spindle tuber spreads from diseased to healthy plants, and it may be transmitted by aphids and by artificial methods of juice transfer. It is thought that probably weather and climate conditions influence the disease and rate of its spread.

The securing and isolation of the disease-free stocks are considered more advisable as control measures than tuber selection, hill selection, removal of diseased hills, or attempts at insect control.

**Dry top rot of sugar cane, a vascular disease,** J. MATZ (*Jour. Dept. Agr. and Labor Porto Rico*, 6 (1922), No. 3, pp. 28-47, figs. 6).—Further observations have been made on the distribution of sugar cane dry top disease, and data regarding its transmissibility have been obtained since the publication by the author of the description (E. S. R., 46, p. 550) of the causal organism, *Plasmodiophora vascularum*. The distinguishing features are herein published in greater detail.

**Gumming disease of sugar cane,** J. MATZ (*Jour. Dept. Agr. and Labor Porto Rico*, 6 (1922), No. 3, pp. 5-21, pl. 1, figs. 5).—The history of sugar cane gumming disease is outlined more particularly as recorded for Porto Rico, but also as occurring elsewhere.

The disease is particularly serious on account of its preventing development of the growing points and of the second generation canes, and on account of its interference with crystallization in the vacuum pans at the mill.

The apparently greater freedom of the ratoons as compared with that of plant canes is really due to early death of the infected sprouts, leaving the stool perhaps apparently disease-free, for a time at least, though the few resulting canes may show the disease at harvest time.

The yellow gumming exudate which constitutes the principal symptom of the disease may vary in color and abundance. The leaf striping effect or mottling is due primarily to the partial infection of some of the fibers.

Difficulties at first experienced in demonstrating *Bacterium vascularum* as the cause of the gumming disease were proved to be due to strong acidity in the agar medium. Apparently soil is not a favorable medium for the transmission of the disease, which is transferred probably by insects, tools, and driving rains, but not through the soil. The varietal resistance is striking in the case of yellow Caledonia, contrasting with high susceptibility in Otaheite, which acts as a carrier to other susceptible canes. The red cane Cavengerie and another red cane, D-109, show a hopeful degree of resistance to gumming diseases.

**Recent developments in the study of the nature of mosaic disease of sugar cane and other plants,** J. MATZ (*Jour. Dept. Agr. and Labor Porto Rico*, 6 (1922), No. 3, pp. 22-27, figs. 3).—Recapitulating the facts set forth in his article previously noted (E. S. R., 44, p. 846), the author cites also confirmatory or related findings by Kunkel (E. S. R., 46, p. 743) and by Palm (E. S. R., 49, p. 148), with discussion of published claims and of methods.

**Researches on the root disease of sugar cane,** B. A. BOURNE ([*Bridge-town:*] *Barbados Dept. Agr.*, [1922], pp. [1]+17, pls. 5).—This paper is the outcome of extended research with a view to determining those factors possibly contributing toward root disease of sugar cane in Barbados, and to applying



them under controlled experimental conditions in order to establish definitely their relationship to the disease.

In the light of the researches indicated it would appear that the main factors contributing toward root disease may vary from one country to another. It is claimed that root disease is not confined to any specific type of soil. Plant canes do not appear to be seriously attacked, but ratoon canes seem to be especially susceptible under certain conditions. Either *Rhizoctonia solani* or *R. pallida* has been found associated with freshly diseased and dying cane roots in typical cases of root disease. In advanced stages the basal portions are infested by one or the other of these fungi, sometimes with the addition of *Fusarium*. *Marasmius sacchari* has been isolated only from dead canes.

Recommendations include the planting of healthy cuttings of varieties found to be resistant; the suitable rotation of crops so that the parasitic root fungi are forced to live saprophytically, thus reducing their virulence; proper tillage and drainage to provide good soil aeration and root space, this conducing to maximum vitality; and proper trashing of fields of young plant and ratoon canes to conserve soil moisture and to keep down temperature.

**Control of damping-off and foot rot of tomatoes**, W. F. BEWLEY (*Jour. Min. Agr. [Gt. Brit.]*, 28 (1921), No. 7, pp. 653, 654).—Tomato seedling damping-off has been further studied since the publication of previous accounts (E. S. R., 45, pp. 546, 652), and the remedy, herein designated as Cheshunt Compound, has been elaborated. The preparation contains 2 parts by weight of copper sulphate to 11 parts of ammonium carbonate, both reduced to a fine state and thoroughly mixed. The dry mixture is kept tight in glass or stone before using, for which purpose it is dissolved in a little hot water and made up to 1 gal. of water for 0.5 oz. of the mixture.

Though plants attacked usually die eventually, the soil organisms may be killed by the solution, immediately after which planting may occur without injury but with gain of vigor to the young plants. Detailed descriptions are given.

The treatment described has proved its value against damping-off of many seedlings besides tomato, though in case of very delicate seedlings the solution must be more dilute. Preliminary experiments with the preparation upon other root diseases have also proved satisfactory.

**A study in disease susceptibility**, B. T. DICKSON (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 15 (1922-23), p. 60, pl. 1).—Discussion, with illustrations, is given regarding comparative susceptibility of tobacco plants to mosaic.

**A bacterial disease of turnip (*Brassica napus*)**, S. G. JONES (*Jour. Agr. Sci. [England]*, 12 (1922), No. 3, pp. 292-305, pl. 1).—During recent years a disease of root crops has been known in North Wales, in the course of which the heart or core of the root is converted into a soft putrid mass, the rind and mature foliage remaining intact. The disease is likely to appear on land treated with lime as a preventive against *Plasmodiophora brassicae*, or on land which has received a heavy dressing of nitrogenous fertilizers which tend to force the crop and so produce watery, sappy roots. The author found that the organism isolated refused to grow on any media which were not neutral or alkaline. This disease was observed and investigated on a crop of white turnips grown on the farm of the University College of North Wales, the land having received a dressing of sodium nitrate. Close examination showed that the very young leaves at the center of the crown had been destroyed, thus forming a tiny wound into which a probe could be pushed 3 or 4 in. This wound was often concealed by three to five secondary crowns all bearing healthy luxuriant foliage. The soft rot was always confined to the core of the root, with a brown-colored zone at the boundary of the diseased area.



The pasty mass in the core showed bacteria, which were studied. The characters of the organisms are described in comparison with those of others producing somewhat similar effects. While the organism isolated shows many characters in common with *Pseudomonas campestris* and with *Bacillus oleraceae*, it appears most nearly related to *P. destructans*, of which it is regarded as a varietal form.

**Silver leaf disease of fruit trees and its occurrence in South Africa**, V. A. PUTTERILL (*Union So. Africa Dept. Agr., Sci. Bul.* 27 (1923), pp. 19, figs. 10).—Distinction is drawn between false silver leaf (physiological) and the true disease. The latter is due to the fungus *Stereum purpureum*, which enters at wounds and spreads to living wood, usually killing the tree. This fungus was found formerly at three places in South Africa, but not definitely associated with a silverying of the foliage. Recently *S. purpureum* has been isolated from trees typically silvered, and reinoculation reproduced the silverying in the spring.

The control measures recommended are protection by means of tar of any wounds and the cutting out and immediate burning of diseased wood, being careful to cut beyond the zones showing discoloration and to sterilize pruning tools.

Resistance or immunity may offer a solution of what appears to be a situation increasing in importance.

**Some results from spraying and dusting apples in Quebec**, C. E. PETCH (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 15 (1922-23), pp. 94-96).—During four years spraying systems were tested in the same orchard on the apple variety Fameuse, chosen for its high susceptibility to apple scab (*Venturia pomi*) and many common insects, especially the apple maggot (*Rhagoletis pomonella*). Results, as tabulated with discussion, show greater injury to foliage by Bordeaux mixture than by lime sulphur, particularly when wet weather followed the application. The Bordeaux plot showed 6 per cent of scab, the lime sulphur less than 4 per cent.

Calcium arsenate was equal, as regards insect control, to lead arsenate, but is preferred on account of greater cheapness and freedom from chemical reaction when mixed with lime sulphur. Injury due to combined lead arsenate and lime sulphur during 1921 is described.

Dry lime sulphur did not give satisfactory control of apple scab on the most important local varieties, McIntosh and Fameuse.

Dusting continued to give satisfactory results, reducing scab to 1 per cent in one Fameuse orchard. Bordeaux dusts cause bronzing and russetting each year, so that their use is not recommended. Wheat flour is the only adhesive that receives favorable mention.

**[American gooseberry mildew and its control]**, W. KONOPACKA and J. TRZEBIŃSKI (*Pam. Państw. Inst. Nauk. Gosp. Wiejsk. Puławach (Mém. Inst. Natl. Polonais Écon. Rurale Puławy)*, 1 (1921), A, No. 2, pp. 158-163).—*Ribes grossularia*, sprayed with milk of lime (10 per cent) before the leaves appeared and three times after blooming with different solutions, showed the best results from arsenical preparations ( $As_2O_3$  and  $NaAsO_2$ ) in aqueous solutions of strengths of 0.01 and 0.05 per cent. The branches were but little infected and the berries were practically clean, but the leaves were severely scorched. A similar but less severe injury was done by a solution of Schweinfurt green (0.06 per cent, with 0.2 per cent lime), and by liver of sulphur at 0.25 per cent. Following applications of soda at 1 per cent, very little infection occurred.

**A new type of orange rust on blackberry**, B. O. DODGE (*Jour. Agr. Research [U. S.]*, 25 (1923), No. 12, pp. 491-494).—The author describes an inter-

mediate form of orange rust on blackberry in which the sori are darker and more reddish orange than in the typical long-cycle rust on the same leaf, while the spores correspond in shape and size with those of the typical long-cycle form. The possible systematic relations of this new form are described.

**Effect of the orange rusts of *Rubus* on the development and distribution of stomata**, B. O. DODGE (*Jour. Agr. Research* [U. S.], 25 (1923), No. 12, pp. 495-500, pl. 1, fig. 1).—The author claims that by an interaction of host to parasite there are developed about as many stomata on the dorsal sides of blackberry and raspberry leaves as on the lower sides when the plants are attacked by the orange rust.

**Blue stem of the black raspberry**, J. F. HOCKEY (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 15 (1922-23), pp. 92, 93).—The black raspberry blue stem condition as noted by Lawrence (*E. S. R.*, 28, p. 348) was found during the season in localities indicated and is briefly discussed in connection with studies made. These leave still in doubt the identity of the fungus, which is said to resemble closely *Acrostalagmus caulophagus*.

**A fungus of economic importance on the avocado (*Persea americana*)**, E. M. DODGE (*Bothalia*, 1 (1922), No. 3, pp. 179-186, figs. 7).—During 1921 twigs of avocado trees appearing in bad condition showed the presence of a fungus, the effect of which resembled that produced by *Physalospora cydoniae* on apple limbs and twigs. The fruits were also affected in a way apparently identical with the effect mentioned in a paper by Stevens (*E. S. R.*, 43, p. 550). The organism, regarded as a new species, is described under the name *P. perseae*.

**Diseases of cacao in Trinidad**, W. NOWELL (*Agr. Soc. Trinidad and Tobago Proc.*, 22 (1922), No. 5, pp. 483-493).—Trinidad cacao diseases, as here dealt with from the standpoint of practical protection locally, include die-back, *Diplodia* pod rot, algal disease, thread blight, *Rosellinia* root disease, black pod rot, and canker.

**Heart rot in *Tectona grandis***, T. ALTONA (*Tectona (Boschbouwk. Tijdschr.)*, 16 (1923), No. 5, pp. 456-473, pl. 1).—In many plantations of teak (*T. grandis*) in Bodjonegoro, Java, a heart rot occurs which extends inward, spreading also both laterally and vertically. The disease, which is probably due to a fungus, shows itself outwardly by the occurrence of numerous adventitious buds, by dead tops, and by clefts in the bark. The typical final effect on the tree is not yet known. The disease may attack other species, which show like symptoms.

**A study of soft rot of iris**, J. K. RICHARDSON (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 15 (1922-23), pp. 105-120, pls. 3).—Of the 250 varieties of iris which have been grown at Macdonald College, about 120 have died out from disease during five years, mainly a soft rot also found near the college, London, Montreal, and Toronto. The disease is described as occurring and progressing in different plant parts and under certain conditions, as shown by studies outlined. This rot is increasing in importance and is probably already widely distributed, being economically important also on account of its destructiveness.

The disease, a typical soft rot attacking the rhizome parts as well as the foliage, is said to be caused by two forms of *Bacillus carotovorus*, which has been claimed to be identical with *B. oleraceae*, *B. omnivorus*, and *B. apivorus*. The pathogene destroys the host by a dissolution of the middle lamellae of the cells, a gradual destruction of the cell contents, and finally a total disintegration of the diseased tissues.

**Peony diseases**, J. G. COULSON (*Quebec Soc. Protect. Plants, Ann. Rpt.*, 15 (1922-23), pp. 67-70, pls. 2).—In the two summers during which peony diseases



have been under observation at Macdonald College most varieties have shown severe infection, and indications are that diseases of peonies are widespread in Quebec and Ontario. The troubles noted include Botrytis blight (*B. paeoniae*), Cladosporium leaf blotch (*C. paeoniae*), Septoria leaf spot (*S. paeoniae berlinensis*), mosaic, two leaf spots of unknown causation, and a disease of the underground parts. The most troublesome of these is the Septoria leaf spot.

## ECONOMIC ZOOLOGY—ENTOMOLOGY.

**Animal life in deserts**, P. A. BUXTON (*London: Edward Arnold & Co., 1923, pp. XV+176, pls. 14, figs. 20*).—A study of the fauna in relation to the environment.

**The book of the otter**, R. CLAPHAM (*London: Heath Cranton, Ltd., 1922, pp. 158, pls. 7, figs. 5*).—This work is intended as a manual for sportsmen and naturalists.

**Directory of officials and organizations concerned with the protection of birds and game, 1923**, G. A. LAWYER and F. L. EARNSHAW (*U. S. Dept. Agr., Dept. Circ. 298 (1923), pp. 16*).—This twenty-fourth annual directory (E. S. R., 48, p. 51) shows the officials and organizations concerned with the protection of birds and game, and the publications issued by each.

**The biology of birds**, J. A. THOMSON (*New York: Macmillan Co., 1923, pp. XI+436, pls. 9, figs. 59*).—This work considers the chief characteristics of birds; external features (biologically considered); adaptations of the bird's skeleton; the flight of birds; food—its capture and utilization; the internal economy of the bird's body; adaptation to haunts; migration; courtship and sex; birds' eggs; parental care and nest making; senses, instincts, and intelligence; the pedigree of birds; birds and evolution; and birds and the web of life. A bibliography of 11 pages is included.

**Propagation of wild birds**, H. K. JOB (*Garden City, N. Y.: Doubleday, Page & Co., 1923, pp. XXI+308, pls. 62*).—A manual of applied ornithology treating of practical methods of propagation of quail, grouse, wild turkey, pheasants, partridges, pigeons and doves, and waterfowl in America, and of attracting and increasing wild birds in general, including song birds.

**A natural history of the ducks**, J. C. PHILLIPS (*Boston: Houghton Mifflin Co., 1922, vols. 1, pp. XI+264, pls. 45; 2, pp. XII+409, pls. 63*).—The first volume of this four-volume work, which is illustrated by plates in color and in black and white from drawings by F. W. Benson, A. Brooks, and A. G. Fuertes, deals with the subfamilies Plectropterinae, Dendrocygninae, and Anatinae (in part), of the family Anatidae. Volume 2 deals with the genus *Anas*.

**Inland birds: Northern observations by a sportsman**, H. M. BATTEN (*London: Hutchinson & Co., 1923, pp. 288, pls. 31*).—This book, with an introduction by H. Maxwell, is an account of the author's observations.

**Game birds and wild fowl of Great Britain and Ireland**, A. THORBURN (*London and New York: Longmans, Green & Co., 1923, pp. VII+79, pls. 30*).—The author presents 30 plates in colors showing 58 species specially prepared for this volume of game birds and wild fowl that inhabit or pay passing visits to the British Islands, accompanied by descriptive accounts.

**Birds of the Netherlands, I**, E. D. VAN OORT (*De Vogels van Nederland. The Hague: Martinus Nijhoff, 1922, pt. 1, pp. XII+250, pls. 87, figs. 3*).—The first volume of the author's work on birds of the Netherlands deals with the orders Colymbiformes (pp. 1-26), Procellariiformes (pp. 27-45, 237, 238), Pelecaniformes (pp. 46-60), Ardeiformes (pp. 61-109), and Anseriformes (pp. 110-235). Descriptive accounts are given of 71 forms. with colored plates of each.

**Indian bird life**, M. R. N. HOLMER (*London and Bombay: Humphrey Milford, 1923, pp. [X]+100, pl. 1*).—This is a small popular account, including three appendixes, which present tabular summaries of information.

**The parasites of Australian birds**, J. B. CLELAND (*Roy. Soc. So. Aust. Trans. and Proc., 46 (1922), pp. 85-118*).—Part 1 of this paper (pp. 87-104) consists of a list of recorded parasites of Australian birds, part 2 (pp. 104-118) of parasites of Australian birds that have come under the author's notice.

**Researches on the insect metamorphosis**, O. W. TIEGS (*Roy. Soc. So. Aust. Trans. and Proc., 46 (1922), pp. 319-527, pls. 16, figs. 8*).—Part 1 of this work is on the structure and postembryonic development of a chalcid wasp, *Nasonia brevicornis* or *N. abnormis* Boh., a parasite on exposed muscid pupæ in the United States and Australia (pp. 326-492), and part 2 is on the physiology and interpretation of the insect metamorphosis (pp. 492-504). A bibliography of 70 titles is included.

**Insect pests and their control**, P. J. FRYER (*In Insect Pests and Fungus Diseases of Fruit and Hops. Cambridge: Univ. Press, 1920, pp. 25-476, pls. 12, figs. 229*).—This first part of the work on insect pests and fungus diseases deals with insect pests and their control. An introductory account of insects first presented (pp. 27-46) is followed by accounts of insect pests (pp. 47-385) and of insecticides as means for insect control (pp. 387-476). Eight plates are presented in color.

**Dusting with insecticides: Results of dry application as compared with spraying in Hawaii**, H. T. OSBORN (*Facts About Sugar, 13 (1921), No. 24, pp. 472, 473*).—This is an account of the experimental use of dry insecticides against crop pests in Hawaii. In work with the sugar cane leafhopper nicotin dust gave a rather better kill on the plats than spraying at the strengths employed.

**Observations on the bionomics of the bed bug, *Cimex lectularius* L., with special reference to the relations of the sexes**, F. W. CRAGG (*Indian Jour. Med. Research, 11 (1923), No. 2, pp. 449-473*).—Studies here reported have been summarized as follows:

"Both sexes of *Cimex* are fully mature soon after the final molt, and the female may be impregnated before either sex has fed. The female will feed as readily before impregnation as after. The eggs do not begin to develop until they are fertilized, and only a few eggs are laid until after the female has had a meal of blood. The number of eggs is dependent on the amount of food the female obtains, but also on the state of the male. Females impregnated by unfed males do not produce so many eggs as females impregnated by fully nourished males. Copulation is very frequent during normal life. A male can fertilize at least three females in 24 hours, and it is probable that copulation occurs not less than once a day in nature.

"One impregnation does not enable the female to lay indefinitely. In two experiments in which the impregnating males had not been fed, 48 and 43 normal eggs were laid; in two experiments in which the males were fed the females laid 173 and 133 normal eggs. Toward the end of these experiments, when the supply of spermatozoa was becoming exhausted, only malformed and sterile eggs are laid. The presence of more than one male makes no difference in the number of eggs laid. The spermatozoa are not retained intact by the female during periods of starvation at temperatures suitable for oviposition; if the period is sufficiently prolonged no eggs are laid when feeding is resumed. If conditions are otherwise favorable to oviposition, shortage of spermatozoa results in the production of deformed and sterile eggs, while lack of food does not."



An experimental study of the sheep trypanosome (*T. melophagium* Flu, 1908), and its transmission by the sheep ked (*Melophagus ovinus* L.), C. A. HOARE (*Parasitology*, 15 (1923), No. 4, pp. 365-424, pls. 5, figs. 5).—This is a report of studies of *Trypanosoma melophagium*, a parasite of European domestic sheep, in the blood of which it occurs in very scanty numbers and can be detected by the cultural method.

"In England it has been found in 80 per cent of sheep examined. The infection is of fairly short duration and does not produce an immunity in sheep, since the latter can easily be reinfected. In all probability *T. melophagium* produces no pathological effect in sheep and is incapable of infecting laboratory animals. Morphologically the sheep trypanosome is closely allied to the cattle trypanosome, *T. theileri*. The intermediate host of *T. melophagium* is the sheep ked, *M. ovinus* L., in the alimentary canal of which it passes through a definite cycle of development ending in the production of infective forms (metacyclic trypanosomes) in the hind-gut of the insect. The mode of transmission is contaminative, the sheep acquiring an infection by ingesting the ked. Infection of sheep did not result from the bite of the ked, through abrasions of the skin, or from inoculation of cultures of the trypanosome. *T. melophagium* is easily cultivated at 30° C. [86° F.]. Its evolution in cultures is similar to that in the invertebrate host."

The distribution of the pink bollworm in Porto Rico, G. N. WOLCOTT (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 85 (1923), pp. 3-7, fig. 1).—The author reports upon a second survey (*E. S. R.*, 48, p. 56; 49, p. 549), made during the winter and spring of 1922-23 and conducted with a view to determining the effect of the continued presence of a few cotton plants as compared with destruction, the direction of the wind, and the climatic differences of the north and south sides of the island upon the spread of this pest.

The survey has shown the entire north coast except around Bayamon and Cataño and around Carolina, Canovanas, and Loiza to be infested by the pink bollworm. It was found that normal dispersion by flight is greater in extent from commercial plantings of cotton than from scattered wild plants, that flight is to some extent aided by winds, and is almost, if not entirely, prevented by arid or semiarid conditions. It was found by J. D. More that 20 per cent of the larvae collected from January to April have a resting stage averaging 128 days in length, the maximum period being 185 and the minimum 42 days. This permits the moths from such caterpillars to emerge in June, July, and August, rather than from February to April, as did 80 per cent. None of the larvae collected in September and October had a resting period, but all transformed to pupae, and adults emerged in October and November.

The pink bollworm situation, W. D. HUNTER (*Calif. Dept. Agr. Mo. Bul.*, 12 (1923), No. 6, pp. 287-294).—This is an address on the present status of the pink bollworm problem and means for its control.

Codling moth control in western districts of the Cape Province, F. W. PETTEY (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 3, pp. 268-276).—In this discussion of the subject the author calls attention to some of the reasons why fruit growers are failing to control this pest.

Begin to fight the corn borer now, W. P. FLINT, J. C. HACKLEMAN, and F. C. BAUER (*Illinois Sta. Circ.* 274 (1923), pp. 8, figs. 6).—This is a brief summary of information on the European corn borer, in which it is pointed out that it may be brought into the State at any time in commercial shipments of infested material.

A note on the toxicity of acids for mosquito larvae, J. H. BODINE (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 45 (1923), No. 3, pp. 149-152).—"Mosquito larvae (*Culex pipiens*) were found to be extremely resistant to rather high



concentrations of various acids. The order of toxicity of the acids used is salicylic>oxalic>HCl>butyric>acetic. The chemicals seem to penetrate the animal orally and not cutaneously. Animals withstand rather high concentration of HgCl<sub>2</sub>, considerably in excess of that found for other organisms cited."

**The Chironomidae of Belgium and particularly of the Flanders zone,** M. GOETGHEBUER (*Mém. Mus. Roy. Hist. Nat. Belg.*, 8 (1921), No. 4, pp. [2]+210, pl. 1, figs. 233).—Following a general discussion of the Chironomidae (pp. 3–16), the author presents a descriptive catalogue of the Chironomidae of Flanders, in which 196 forms are recognized (pp. 16–55). This is followed by tables for the separation of the genera and species of Chironomidae occurring in Belgium, with descriptions of new species (pp. 56–166). Descriptions of additional species are appended (pp. 167–184), as is a catalogue of the Chironomidae of Belgium (pp. 185–199) and a bibliographical index (pp. 201–204). An index to the genera and species is included.

**Notes on larval characters in the genus Sarcophaga,** F. M. ROOT (*Jour. Parasitol.*, 9 (1923), No. 4, pp. 227–229 pl. 1).—In the course of the author's studies larvae of nine species or varieties of Sarcophaga have been obtained, of which seven were reared to the adult stage and identified. All of these are said to be common species, whose larvae live either in fecal matter or in decaying meat. The structural differences observed are reported upon. An examination of even this scanty material shows that there are some decided differences between the spiracles of different species or groups of species.

**Observations on the morphology and life history of Herpetomonas muscae-domesticae in North American muscoid flies,** E. R. BECKER (*Jour. Parasitol.*, 9 (1923), No. 4, pp. 199–213, pl. 1, figs. 3).—The author's studies here reported have led to the following conclusions:

"*H. muscae-domesticae* was found to be entozoic in the North American muscoid flies, *Musca domestica*, *Phormia regina*, *Lucilia sericata*, *Calliphora erythrocephala*, *Cochliomyia macellaria*, and *Sarcophaga bullata*. The seat of infection is throughout the length of the alimentary canal. The flagellate in its life history exhibits the adult long flagellated form, the cyst, and the intermediate stages from the crithidial to the trypaniform type. The parabasal body stains with Janus green after the typical mitochondrial fashion. The only method of multiplication found was binary fission. During division the chromatin of the nucleus is resolved into a number of fragments, usually four in each of the daughter cells. Feeding experiments indicated that the flagellated form of the parasite is infective, and that there is no obligatory cycle which must be completed before the parasites of one host are infective to another. No evidence for hereditary transmission of *H. muscae-domesticae* was found. Attempts to find infected larvae or to experimentally infect them were failures."

**Experiments with certain Diptera as possible transmitters of bovine onchocerciasis,** T. H. JOHNSTON and M. J. BANCROFT (*Roy. Soc. Queensland Proc.*, 32 (1920), pp. 31–57, figs. 16).—A brief survey of the literature is followed by a report of investigations by the authors, which have been summarized as follows:

"An examination of the following flies captured in the Eidsvold district, where worm nodules are known to occur in cattle, failed to reveal the presence of *Onchocerca* larvae: (1) *Tabanus circumdatus*, (2) *T. mastersi*, (3) *T. dubiosus*, (4) *T. cyaneus*, (5) *T. australicus*, (6) *Musca fergusonii*, (7) *M. vetustissima*, (8) *M. terrae-reginae*, (9) *Fannia* sp. The tabanids, *T. circumdatus*, *T. dubiosus*, *T. mastersi*, and *T. australicus*, as well as the three above named species of *Musca* and *Fannia* sp., failed to become infested with



larvae when fed on freshly cut worm nodules. A second species of *Onchocerca* (*O. bovis* Piettre) infests Australian cattle. *T. circumdatus* is commonly parasitized by a filarial larva (*Agamofilaria tabanicola*), while the three muscids, in addition to harboring larval *Habronema muscae* and *H. megastoma*, are infested by certain other larval nematodes. A species of *Fannia* commonly associated with cattle also harbors a larval nematode."

**The life histories of *Musca australis* Macq. and *M. vetustissima* Wlk.,** T. H. JOHNSTON and M. J. BANCROFT (*Roy. Soc. Queensland Proc.*, 31 (1919), pp. 181-203, figs. 26).—This is a report of studies of two bush flies, both of which are abundant during the summer in the Upper Burnett District, Queensland, conducted in the course of studies of Australian Diptera as transmitters of certain nematode parasites of livestock.

**Fruit fly and cold storage** (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 4, pp. 364, 365).—This is an account taken from a report by C. P. Lounsbury made to the Secretary for Agriculture. Attention is called to the demonstration by Mally that fruit-fly larvae may live in cold storage at about 34° for six weeks, and then successfully transform to flies. This greatly emphasizes the need for the packers of export fruit, most particularly of peaches and nectarines, to select fruit for export with extreme care to avoid the inclusion of any that have become infested by the pest.

**Fleas found on wild animals in the Bitterroot Valley, Mont.,** L. H. DUNN and R. R. PARKER (*Pub. Health Rpts. [U.S.]*, 38 (1923), No. 47, pp. 2763-2775).—The authors report upon identifications made of 25 fleas, representing 2,275 individuals taken from 17 host animals, or 388 individuals. Four species are described as new, of which one represents the new genus *Micropsylla*. A host index is included.

**The life of the weevil,** J. H. FABRE, trans. by A. T. DE MATTOS (*New York: Dodd, Mead & Co.*, 1922, pp. [7]+346).—This third volume of Fabre's work on beetles (*E. S. R.*, 42, p. 455) consists of the essays on weevils contained in the *Souvenirs Entomologiques* (*E. S. R.*, 50, p. 151).

**More beetles,** J. H. FABRE, trans. by A. T. DE MATTOS (*New York: Dodd, Mead & Co.*, 1922, pp. [8]+322).—This is the fourth and last volume on beetles in the Collected English Edition of Fabre's entomological works.

**The mystery of the hive,** E. EVRARD, trans. by B. MIALl (*London: Methuen & Co., Ltd.*, 1923, pp. [4]+369).—This is a translation of a popular work by the author.

**Catalogue of Australian bees,** H. HACKER (*Mem. Queensland Mus.*, 7 (1921), No. 3, pp. 99-163).—The author lists 872 species of bees, representing 50 genera, from Australia.

**A wasp that hunts cicadas,** W. M. SAVIN (*Nat. Hist.*, 23 (1923), No. 6, pp. 569-575, pl. 1, figs. 8).—This is an account of observations of the habits of *Sphecius speciosus*.

**A new *Macrocentrus* reared from the strawberry leaf roller,** S. A. ROHWER (*Ent. Soc. Wash. Proc.*, 25 (1923), No. 7-8, p. 168).—Under the name *M. ancylivora* the author describes as new a braconid parasite reared from the larvae of *Ancylis comptana*, at Riverton, N. J.

**Notes on the chalcid parasites of muscoid flies in Australia,** T. H. JOHNSTON and M. J. BANCROFT (*Roy. Soc. Queensland Proc.*, 32 (1920), pp. 19-30, figs. 7).—The studies here reported upon, in connection with a bibliography of 21 titles, have led to the following summary:

"There exist in Eastern Australia at least five hymenopterous parasites which destroy flies (including sheep maggot flies), namely, *Spalangia muscidarum*, *Nasonia brevicornis*, *Chalcis calliphorae*, *Dirrhinus sarcophagae*, and *Pachyocrepoides dubius*. Of the various hymenopterous parasites known

elsewhere as destroying fly pupae, three others appear to be of outstanding importance, namely, *Alysia manducator*, *Aphaereta cephalotes*, and *Melittobia acasta*. The last named acts also as a hyperparasite of many useful insects (including *A. manducator* and tachinids), and should not, in the light of our present knowledge, be introduced into Australia. The other two could apparently be safely introduced if desired to assist those parasites already present. The first named seems to be especially valuable in this connection."

### FOODS—HUMAN NUTRITION.

**Care of food in the home** (*U. S. Dept. Agr., Farmers' Bul. 1374 (1923), pp. 11+13*).—In this revision of Farmers' Bulletin 375 (*E. S. R.*, 22, p. 167), the subject matter has been greatly condensed to present in the most concise manner possible the various causes of spoilage in foods, the proper means of food storage in the home, and simple rules governing the care of the various types of foods.

[**Food and its preparation**], **Chicago State Hospital**, D. D. COFFEY (*Ill. Inst. Quart.*, 14 (1923), No. 1, pp. 194-200).—In a reorganization of the kitchens and dining rooms, the ration of the patients has been increased from 100 gm. protein and 3,000 calories of energy to 120 gm. protein and 3,600 calories. The replacement of oilcloth by linen tablecloths has been found to be more satisfactory and no more expensive.

[**Foods at**] **Lincoln State School and Colony**, S. A. GRAHAM (*Ill. Inst. Quart.*, 14 (1923), No. 1, pp. 205-213).—Data are given regarding the food for boys and girls in this institution for feeble minded. The meals, it is stated, provided on an average 115.87 gm. protein and 3,410.5 calories per patient.

[**Diet kitchens v. a central kitchen**], **Peoria State Hospital**, G. A. ZELLER (*Ill. Inst. Quart.*, 14 (1923), No. 1, pp. 186-191).—On the basis of experience, the conclusion is drawn that diet kitchens for the various cottages and groups are superior to central kitchens.

**The nem system of feeding**, T. L. BIRNBERG (*Minn. Med.*, 6 (1923), No. 10, pp. 579-585, figs. 2).—This is a brief discussion of the essential features of the Pirquet nem system of feeding, with illustrations of the method of determining sitting height and charts showing the application of the method.

**Studies on the digestibility of proteins in vitro.**—IV, **On the digestibility of the cottonseed globulin and the effect of gossypol upon the peptic, tryptic digestion of proteins**, D. E. JONES and H. C. WATERMAN (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 501-511, figs. 4).—Continuing the series of studies previously noted (*E. S. R.*, 48, p. 61), the authors have studied, by methods outlined in earlier papers of the series (*E. S. R.*, 46, p. 163), the comparative digestibility in vitro of cottonseed globulin and casein, of pure cottonseed globulin and cottonseed globulin to which 1 per cent of gossypol had been added, and of pure casein and casein containing 1 per cent of gossypol. The object of making the comparison of the pure cottonseed globulin and the mixtures with gossypol was to determine whether the inferior values obtained by various workers in determinations of the digestibility of cottonseed meals and flours are due to the presence of the toxic principle gossypol, as suggested by the work of Withers and Carruth (*E. S. R.*, 38, p. 685).

The results obtained tend to confirm this opinion. The digestion of the pure cottonseed globulin by the successive action of pepsin and trypsin proceeded at about the same rate and to the same extent as that of casein, but the addition of gossypol interfered markedly with the digestion of the cottonseed globulin by pepsin and trypsin and by pepsin alone, as well as the digestion of casein by pepsin and trypsin.



The tentative conclusion is drawn that the incomplete digestion by animals of the protein content of cottonseed press cake preparations is due to an inhibitive effect of gossypol.

**Intermediary metabolism of carbohydrates**, P. A. SHAEFFER (*Physiol. Rev.*, 3 (1923), No. 3, pp. 394-437).—This is an extensive review and discussion of the literature on the reactions of glucose in the animal body as representing the intermediary metabolism of carbohydrates. The reactions involved are classified in three groups. The first involves only reversible rearrangements within the glucose molecule, particularly the formation of  $\gamma$ -glucose and its condensation to polysaccharids (glycogen), in which little or no energy change takes place. The second group includes the reactions from glycogen or  $\gamma$ -glucose to lactic acid, involving no oxidation and but little energy change, but a splitting of the 6-carbon molecules into 3-carbon fragments. The third group deals with the oxidation of the 3-carbon fragments of glucose, during which the bulk of the energy is liberated. A bibliography of 202 titles is appended.

**Influence of a milk diet on the skeleton**, V. KORENCHESKY and M. CARR (*Biochem. Jour.*, 17 (1923), No. 2, pp. 187-203, figs. 6).—The investigation reported in this paper consisted of a study of the effect on the skeleton of rats of large, medium, and small doses of fresh, heated, and oxidized milk. In each case the milk was divided into three parts, one of which was used fresh, one heated in a flask in a bath of boiling water for seven hours, and one heated in the same way but at the same time aerated by a brisk stream of air.

In the first series of experiments the milk was fed ad libitum, with 3 per cent of cane sugar added to increase its caloric value. To be certain of adequate B and C vitamins, the rats each received daily 3 gm. of a paste composed of starch 57 gm., yeast 11.4 gm., orange juice 13.6 cc., and oxidized milk 18 cc. For control purposes, during the latter part of the experiment some of the rats received in addition to this paste 0.03 gm. daily of cod liver oil. The feeding was begun at weaning and continued for about three months.

No appreciable difference was noted in the weight curves of the different groups nor in the chemical composition of the skeleton, thus showing that with the large amounts of milk used oxidation did not destroy all of the vitamin A. In one experiment, which was carried into the second generation, the young were not normal in external appearance, but chemically the skeleton was normal in structure, although showing considerable osteoporosis.

In the second series the amount of milk was limited to from 15 to 30 cc. daily, the caloric value being made up by extra starch incorporated in the vitamin paste or in some cases by a 17 per cent solution of cane sugar with which the milk was diluted. The rats were first fed from 13 to 34 days on oxidized milk ad libitum and then transferred to the restricted milk diet. At the end of the experimental period the composition of the skeleton of the animals fed on the milk diluted with the sugar solution was much worse than that of the animals fed even smaller amounts of milk with starch, the water content being about 8 per cent higher and the calcium content about 15 per cent lower.

In the third series of experiments the effect was studied of the addition of small doses of milk, 5 cc., to a vitamin A-deficient diet upon which the animals had been kept for some time previously. The addition of this small amount of milk had a favorable effect upon the growth of the animals. This was most marked in the case of the fresh and least in the case of the oxidized milk. Similar differences could be noted in the composition of the skeleton, the oxidized milk causing no or only slight improvement.

In commenting on these results, attention is called to the fact that heating the milk at 100° C. for seven hours almost invariably decreased to some ex-



tent both the growth-promoting and antirachitic properties of the milk. Since this could not be explained by the separation of calcium salts, and since previous observations had indicated that simple heat does not destroy the fat-soluble factor, the possibility is suggested that "milk contains besides a fat-soluble factor another special factor which to some extent is disintegrated by boiling." Attention is also called to the fact that on oxidation no considerable decrease in the growth-promoting properties of the milk took place without simultaneous loss of antirachitic properties. This is not in agreement with McCollum's observations concerning the relative decrease after oxidation of the antixerophthalmic and antirachitic vitamins in cod liver oil. In explanation of this discrepancy three possibilities are suggested: (1) That the difference is due to the much lower content of antirachitic vitamin in milk fat than in cod liver oil, (2) that the physical condition of the milk fat in the whey may alter the conditions of oxidation of the fat-soluble factor, or (3) the possibility, as suggested above, of the existence of a special factor in milk different from the fat-soluble factor.

**The availability of calcium salts,** H. STEENBOCK, E. B. HART, M. T. SELL, and J. H. JONES (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 375-386, pl. 1, fig. 1).—In three series of feeding trials conducted on young rats with diets furnishing equivalent amounts of various calcium salts to the extent of 0.3, 0.4, and from 0.133 to 0.14 per cent of the ration, no difference could be detected in the availability of calcium lactate, carbonate, phosphate, silicate, or sulphate.

**Action of light on growth,** E. WOLLMAN and M. VAGLIANO (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 23, pp. 1653-1655, fig. 1).—The growth curves are given of three lots of 3 rats each, all of which were kept on a basal diet of purified casein, polished rice, and salts, with the addition of 2 per cent of yeast extract and 5 per cent of fat. In the first group the fat consisted entirely of butter, while in the other two groups it was composed of 1 per cent of butter and 4 per cent of olive oil. The animals were kept in the dark, but those in the second and third groups received daily irradiation of from 3 to 5 minutes from a mercury vapor quartz lamp.

The growth of the irradiated animals on 1 per cent of butter was as marked as that of those on 5 per cent of butter and superior to that of the nonirradiated animals on 1 per cent of butter. When the diet contained no butter irradiation produced no effect. It is concluded that light does not have the power of compensating for the absence of the fat-soluble growth-promoting factor, but has a favorable effect in the presence of an insufficient quantity of this vitamin.

**Studies on yeast.—VI, On the continuous growth of *Saccharomyces cerevisiae* in synthetic mediums,** E. I. FULMER and V. E. NELSON (*Jour. Infect. Diseases*, 33 (1923), No. 2, pp. 130-133).—This paper, which is a continuation of the series of studies on yeast previously noted (*E. S. R.*, 49, p. 562), is essentially a reply to the paper of Robertson and Davis (*E. S. R.*, 49, p. 460) in which the conclusion was drawn that yeast can not continue to grow in a synthetic medium.

The authors consider that failure to secure growth of yeast in a synthetic medium may be due to one or more of four causes: "The medium may not be the best synthetic medium under the condition of the experiment; the wrong temperature may be used for a medium otherwise satisfactory; the culture is impure; the culture is subcultured too rapidly." Illustrations are given of failures from these various causes. In reply to the suggestion of Robertson and Davis that the use of impure chemicals was the cause of success in subculture, it is stated that yeast grew equally as well in media containing sugar which had previously been extracted for 7 days with 95 per cent alcohol as in media containing unpurified sugar.



The synthesis of "bios" by yeast grown in a solution of purified nutrients, M. B. MacDONALD (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 489-499).—Experiments are reported which appear to furnish convincing evidence that vitamin B and bios, or the yeast growth stimulant named by Funk vitamin D, are not identical.

The method employed was similar to that described in a previous paper in which evidence was furnished that yeast synthesizes vitamin B (E. S. R., 48, p. 760). Suspensions of yeast cells, which had been growing with fresh inoculation every week for two years on one of the synthetic media employed in the previous study, were added to the sterile medium, to which were also added extracts of yeast grown in different media, or extracts of wheat germ, malt, peptone, autoclaved steak, and Liebig's beef extract. The effect of the addition of these extracts was determined by filtering off the yeast at the eighth day of the experiment and comparing the weight of the dried product with controls not receiving the extract. In all cases the addition of these extracts was followed by increased production of yeast. In similar experiments in which the original seedings of yeast were so small that there was no growth in the controls, there was also a measurable increase in the flasks containing the extracts.

The author concludes that yeast is able to synthesize its bios, but that "bios does not function in the manner of a vitamin, since development in an animal is impossible in the absence of an indispensable nutrient principle of this class which the organism does not elaborate. Rather bios appears to be a substance which, while capable of synthesis by the yeast cell, is formed with some difficulty. Yeast cells developing slowly in a bios-free nutrient solution accumulate the substance, so that extracts made from them accelerate the growth of seedings by providing it in abundance."

**Fat-soluble vitamin, XI-XIII** (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 327-373, figs. 11).—In continuation of the series previously noted (E. S. R., 47, p. 464), three papers are presented.

**XI. Storage of the fat-soluble vitamin**, H. Steenbock, M. T. Sell, and E. M. Nelson (pp. 327-343).—The question of the storage of vitamin A in the body was studied by a comparison of the growth, nutritive condition, and length of life of young rats placed on a diet deficient in vitamin A after having been on an ordinary stock ration, as compared with others on the same deficient diet after having been on a ration the vitamin A content of which had been enriched by the addition of 5 parts of cod liver oil to 95 of the other ingredients. The stock ration consisted of yellow corn 76, linseed oil meal 16, crude casein 5, alfalfa 2, sodium chlorid 0.5, and calcium carbonate 0.5 parts, with whole milk ad libitum. The enriched ration was fed to the nursing females 4 days after the birth of their young, and was thus accessible to the young. The vitamin A-deficient ration consisted of hot alcohol-extracted casein 18, salts 4, yeast 2, agar 2, and dextrin 74 parts. The litters were reduced to 6 soon after birth, and the animals were put on the experimental ration at the age of 24 days in the case of those which had previously had the stock ration, and 22 days for those which had had the vitamin A-rich ration. The average weight of the animals at the beginning of the experimental period was 50 and 56 gm., respectively. The maximum weights reached by the two groups were 88 and 176 gm., the length of life 10 and 15 weeks, and the time of developing ophthalmia 7 and 13 weeks. All of these results point to a storage of vitamin A in the tissues of the rats which had been on the vitamin A-rich ration.

In the second series of experiments a comparison was made of the growth of three groups of 4 rats each, one of which was started on the deficient ration

Immediately after weaning, another after having been for 1 week, and the third for 2 weeks after weaning on the vitamin A-rich ration. In the following 8 weeks the animals of the first group gained an average of 4, the second group of 127, and the third group of 135 gm. All of the animals in the first group developed ophthalmia in 8 weeks, and died within 11 weeks, during which time all of the animals in the other two groups remained normal.

That vitamin A is stored in the livers of animals on diets rich in that vitamin was shown by feeding experiments in which livers of rats on diets varying in their content of vitamin A were used as the sole source of the vitamin, both for young rats immediately after weaning and for others which had been allowed to fail on a vitamin A-deficient diet. In both cases the content of vitamin A in the liver was found to vary with the previous diet of the animal from which the livers were obtained.

In conclusion, the advisability is suggested of using as a basal ration for experimental work a diet containing a sufficiency of vitamin A for normal reproduction and rearing of the young, but not furnishing a large excess of this vitamin. Even with this precaution it is considered imperative to place the young on the experimental rations at as early an age as possible.

XII. *The fat-soluble vitamin content of millets*, H. Steenbock, M. T. Sell, and J. H. Jones (pp. 345-354).—The conflicting literature on the vitamin A content of millets is reviewed, and experiments are reported in which four different varieties of millet seed were tested for vitamin A by the methods employed in the previous and other studies in the series. The finely ground seed was fed at 40 and 84 per cent levels in a ration complete in every respect but vitamin A. At the 40 per cent level normal growth was not obtained with any of the millets, and ophthalmia and respiratory infections were frequent. Most of the cases of ophthalmia, however, were too late in appearing to warrant the conclusion that the seed was entirely free from vitamin A. At the 84 per cent level none of the samples furnished enough vitamin A for continued well-being, although a difference was noted in the different samples. No cases of ophthalmia developed until the twelfth week, when 2 out of the 16 showed signs of it.

The failure to grow, combined with the absence or delayed appearance of ophthalmia and indirect evidence of abnormal bone formation, has led to the suggestion that growth was delayed on account of lack of antirachitic vitamin A to a greater extent than of the antiophthalmic vitamin A.

Attempts to correlate the vitamin A content of the millets with yellow pigmentation showed no apparent relation between the two. The Common millet and Hog millet were low in both vitamin and pigment, the White Wonder somewhat richer in both, and the Japanese millet richest in vitamin A and poorest in yellow pigment.

XIII. *Light in its relation to ophthalmia and growth*, H. Steenbock and E. M. Nelson (pp. 355-373).—The authors review the literature on the relation of light to ophthalmia and growth, discussing in particular the paper of Hume (E. S. R., 49, p. 60). In explanation of the results obtained by her, the theory is advanced that the growth response to radiation was due to a compensation by radiation for insufficiency of the antirachitic vitamin as distinguished from vitamin A and continued until vitamin A was exhausted, when ophthalmia and rapid failure of growth ensued. To test this theory, two series of experiments were conducted. In the first 16 rats from 21 to 24 days old and weighing from 40 to 59 gm. each were divided into four groups, all of which were fed a vitamin A-free ration. One group was kept under ordinary laboratory conditions in diffused daylight, one was exposed daily for 10 minutes to ultraviolet light from a quartz mercury vapor lamp, and the third and fourth groups were given



2 per cent of aerated cod liver oil in addition to the basal ration, the fourth group receiving the ultraviolet light treatment as in the second group. In the second series of experiments 12 young rats (6♂ and 6♀) were kept on the basal ration until they ceased to grow, and then were divided into four groups under the same conditions as in the first series. The conditions under which aeration of the cod liver oil destroyed the antiophthalmic fat-soluble vitamin without the antirachitic were first determined by experiments involving the use of 108 rats. It was found that 20 hours of aeration at 100° C. was sufficient for this purpose.

The results obtained in both series of experiments are thought to support the theory advanced. In the first series those on the basal ration and not exposed to radiation grew for the first few weeks and then maintained their weight for a short time, after which ophthalmia or respiratory infection occurred. In the animals receiving radiation or treatment with aerated cod liver oil, growth continued until after the appearance of ophthalmia. In the second series there was a prompt response in growth with exposure to ultraviolet light or the addition of aerated cod liver oil, but ultimately ophthalmia developed and death resulted.

The conclusions of Hume and of Goldblatt and Soames (E. S. R., 49, p. 61) that radiation is without effect when applied in the late stages of maintenance on a vitamin A-free ration are thought to indicate that the animal can respond to antirachitic agencies only as long as vitamin A is present in sufficient amounts. This is thought also to explain why a certain amount of vitamin A in the diet is necessary to the production of rickets in rats. Without it in the diet, unless the animal has a large reserve of it stored away, the animal fails completely from ophthalmia and respiratory infections before the reserves of the antirachitic factor are exhausted and rickets can become manifest.

**Food values and vitamins from the manufacturer's standpoint, A. D. HOLMES** (*Amer. Food Jour.*, 18 (1923), No. 7, pp. 321-323).—Information is summarized regarding work which has been done and work which the author considers desirable in connection with the study of manufacturing uses of oleomargarin. The author discusses the subject on the basis of his experience in experimental studies of fats of different sorts.

**Intensive localized distribution of the spores of *Bacillus botulinus* and probable relation of preserved vegetables to type demonstrated, J. C. GEIGER and H. BENSON** (*Pub. Health Rpts. [U. S.]*, 38 (1923), No. 29, pp. 1611-1615).—In the examination for *B. botulinus* of the soils of a certain ranch in the State of Washington and of vegetables grown on this soil, it was found that the soil contained *B. botulinus*, type B, while from two lots of home-canned string beans and one of home-canned corn prepared on the ranch, type A toxin was obtained. The explanation advanced for these anomalous results is that probably both types of organism were present in the soil, but that the food substances offered a more favorable medium for the growth of type A and suppression of type B. Experimental evidence favoring this theory was furnished by the results obtained on incubation under anaerobic conditions of commercial canned corn and string beans with soil containing type B, controls being run with both soil alone and vegetables alone. Of two specimens of soil alone in 1-gm. amounts, one produced type B toxin. Of eight 1-gm. samples of the same soil, with the addition of autoclaved corn, four yielded toxin of type A. Of the same number of samples with the addition of beans, two yielded type A and one type B toxin.

**Effect of spices on growth of *Clostridium botulinum*, F. M. BACHMANN** (*Jour. Infect. Diseases*, 33 (1923), No. 3, pp. 236-239).—Mince meat and meat containing various ground spices in amounts of 1, 2, and 2.5 per cent were inoculated with *C. botulinum* and incubated under such anaerobic conditions as were obtained by the layer of fat over the meat. No checking of the growth of the organism was noted in the samples containing 1 and 2 per cent of spice, but some retardation of growth was noted with allspice and cloves when used in a concentration of 2.5 per cent. Toxin formation was noted in all cases. It is concluded that spices as used in flavoring foods do not render the food safe if contaminated with *C. botulinum*, and that such foods as mince meat should be sterilized or else heated to the boiling point before being tasted.

### ANIMAL PRODUCTION.

**The internal secretions of the reproductive organs, F. H. A. MARSHALL** (*Physiol. Rev.*, 3 (1923), No. 3, pp. 335-358).—This is essentially a review of the literature relating to the part played by the internal secretions of the reproductive organs in the production of oestrus and pregnancy, and the physiological developments associated with them.

The evidence indicates that oestrus is due to an ovarian hormone, probably secreted by the mature follicle. The ovarian interstitial cells are apparently responsible for secretions which maintain normal uterine nutrition during pregnancy. The action of the interstitial cells on the mammary gland is limited to the slight hypertrophy before ovulation or at the beginning of pregnancy. The corpus luteum "is responsible for the changes which take place in the accessory female generative organs and mammary glands during pregnancy and pseudo-pregnancy."

The active corpus luteum apparently dominates the ovary during pregnancy. It prevents the formation of secretions essential for bringing about oestrus, and also of those which might stimulate pituitary secretions, which would in turn, if not prevented, tend to contract the uterus and bring about parturition. The effect of the secretions of the ovaries and testicles on the development of primary and secondary sexual characters is discussed. Experiments in vasectomy which have resulted in supposed rejuvenation are cited, but the results are difficult to explain. It seems evident, however, that any rejuvenating influence of vasectomy must be due to an atrophy of the glandular substance and a hypertrophy of the interstitial cells of the testicle.

**The alleged effects on body growth and gonad development of feeding pituitary gland substance to normal white rats, C. S. SMITH** (*Amer. Jour. Physiol.*, 65 (1923), No. 2, pp. 277-281).—In studying the effect of feeding desiccated pituitary gland on the body growth and development of the sexual organs, two series of feeding tests were conducted with white rats at the Hull Physiological Laboratory of the University of Chicago. The pituitary material, consisting of anterior or posterior lobe or whole pituitary, was fed in the form of a bread pill before giving the rats their daily ration. Desiccated brain substance was similarly fed to the controls. Thirty males and 26 females were fed in the first experiment which lasted 16 weeks. Records of live weights only were recorded in this test. For the second test which lasted 4 weeks, the 25 males and 24 females used were killed by ether and weights of their testes, ovaries, and uteri recorded. Sections for microscopical examination were also made.

The results, which are presented in tabular form, show no significant effect on growth or gonad development from feeding desiccated pituitary gland substance in amounts varying from 0.05 to 0.3 gm. per day to white rats.



**An improved procedure for metabolism experiments,** G. R. COWGILL (*Jour. Biol. Chem.*, 56 (1923), No. 3, pp. 725-737; *abs. in Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 5, p. 268).—Since a lack of vitamin B in the rations of dogs has been found to destroy their appetite, the author suggests the daily feeding of a minimum dose of material containing vitamin B in a gelatin capsule, apart from the regular food in metabolism experiments. In addition to this, he suggests that the diet should contain a mixture of isolated food substances which will supply all the requirements of the body, with the possible exceptions of vitamin B and the single material that is to be tested.

**A screen used in photographing animals,** C. C. HAYDEN (*Jour. Dairy Sci.*, 6 (1923), No. 4, pp. 299-302, *figs. 3*).—A screen used at the Ohio Experiment Station for photographing experimental animals is described. It consists of a platform on which the animal stands, a background, and a 6-in. mesh adjustable screen placed just far enough away from the background so that the animal may stand between them. The camera is always placed the same distance away.

**Concerning the vitamin B content of the velvet bean,** J. W. READ (*Science*, 57 (1923), No. 1487, p. 750, *fig. 1*).—In a continuation of the studies of the nutritive value of velvet bean meal (beans and pods ground together) (E. S. R., 49, p. 668), "the writer has found that the velvet bean meal carries a good concentration of the B vitamin even after autoclaving for 1 hour at 15 lbs. pressure."

**Economic feeding.—Oil cake for livestock feeding,** P. DECHAMBRE (*Rev. Zootech. [Paris]*, 2 (1923), No. 6, pp. 442-445).—The brief results of several experiments which are noted indicate that copra cake, peanut cake, and palm nut cake are satisfactory and economical feeds for growing calves, production of milk by dairy cattle, and fattening swine, rabbits, and poultry.

**Oat hulls and their use in feeding stuffs,** A. EASTHAM and L. V. BAKER (*Canada Dept. Agr., Seed Branch Circ. 11* (1922), pp. 4).—A discussion of the use of oat hulls in mixed feeds, with suggested methods for their detection.

**Analyses of commercial feeding stuffs and registrations for 1923,** C. S. CATHCART (*New Jersey Stas. Bul. 387* (1923), pp. 70, *fig. 1*).—This is the usual report of the analyses of feeding stuffs inspected during 1922 (E. S. R., 47, p. 570), giving the protein, fat, and fiber content. A list of the manufacturers registering feed for sale in 1923 is also given.

**Commercial feeding stuffs,** J. L. HILLS, C. H. JONES, and G. F. ANDERSON (*Vermont Sta. Bul. 236* (1923), pp. 3-31).—This is the usual report of the official inspection of feeding stuffs for 1923 (E. S. R., 48, p. 660). The 328 brands were analyzed according to the crude protein, crude fiber, and crude fat content and classified according to those meeting their guaranty and according to the grade of the ingredients which they contained.

**Observations on animal breeding in the Orient,** DETTWEILER (*Landw. Jahrb.*, 58 (1923), No. 4, pp. 481-531).—This consists mainly of a discussion of the methods employed in animal breeding and the types of horses, asses, mules, cattle, buffalo, sheep, goats, swine, and fowls found in the Balkans and in European and Asiatic Turkey as observed in five trips to these regions in 1913, 1916, 1917, and 1918. Body measurements for a number of types of sheep and cattle are presented in tabular form. The possible application of some of the findings in this study as an aid to the solution of biological problems is suggested.

**Breeding for beef,** P. J. v. D. H. SCHREUDER (*Union So. African Dept. Agr. Jour.*, 6 (1923), Nos. 1, pp. 29-35, *figs. 5*; 3, pp. 245-252, *figs. 4*; 5, 446-451, *figs. 3*; 6, pp. 519-528, *figs. 7*).—Improvement in the type of beef raised in Union of South Africa and the use of purebred bulls of good quality are recom-



mended. General discussions of care, management, and feeding of the herds, and the relative desirability of the different breeds are also discussed. The results of experiments in fattening cattle of different types are briefly summarized, which show the economical advantage of beef of better type.

**Origin of the Aberdeen-Angus and its development in Great Britain and America** (*Chicago: Amer. Aberdeen-Angus Breeders' Assoc., 1922, 5. ed., pp. 40*).—This is a brief account of the history and origin of Aberdeen-Angus cattle in Great Britain with reference to their first importations and development in America.

**Brahman (zebu) cattle**, V. V. PARR (*U. S. Dept. Agr., Farmers' Bul. 1361 (1923), pp. 11+21, figs. 9*).—This is a discussion of the characteristics of Brahman (zebu) cattle, which are the humped cattle of India. The Nellore, Gir, Guzerat, and Krisna Valley breeds, which are the more prominent ones in Texas, are described, as well as the more desirable types found in India. The success which has attended importations and crosses with the beef breeds has been largely due to the adaptability of Brahman (zebu) cattle to sections of the country having a hot climate, droughts, and where cattle pests are prevalent.

**Steer feeding experiments [at the Charlottetown Experimental Station]**, J. A. CLARK (*Canada Expt. Farms, Charlottetown (P. E. I.) Sta. Rpt. Supt. 1922, pp. 9-11*).—In a steer feeding test, 4 lots of 4 steers, each averaging about 860 lbs. in weight, received daily rations per lot of 40 lbs. of hay, 150 lbs. of turnips, and 25 lbs. of grain. The amount of grain was gradually increased to 45 lbs. at the end of the test, which lasted 147 days. In lot 1 the hay and turnips were fed whole, whereas in lots 2, 3, and 4 they were chopped. In lots 3 and 4 they were mixed together, being moistened with water in lot 4. The feeds were all fed separately in lots 1 and 2. The grain mixture consisted of crushed oats, middlings, bran, oil cake, corn meal, and cottonseed meal in the proportions at the start of the test of 10:10:5:1.5:2.5:2.5, and at the close of the test of 13:16:5:2:7:5:2.

The average daily gains made and the estimated profit per steer were, respectively, lot 1, 2.09 lbs. and \$11.96; lot 2, 2.43 lbs. and \$16.86; lot 3, 2.26 lbs. and \$14.47; and lot 4, 2.37 lbs. and \$15.97.

**Steer feeding [at the Scott Experimental Station]**, M. J. TINLINE (*Canada Expt. Farms, Scott (Sask.) Sta. Rpt. Supt. 1922, pp. 8-10, fig. 1*).—Economic records of five years' steer feeding show that in all but 1920-21 substantial profits of from \$17.77 to \$25.74 per head were made. In 1920-21, however, there was a loss of \$11.80 per head.

In comparing 2-year-old steers and yearlings when fed on rations containing silage and rations containing no silage, 4 lots of 6 steers each were selected, consisting of 2 lots of 2-year-olds and 2 lots of yearlings. The yearlings received daily grain rations of about 2 lbs. per head less than the 2-year-olds, but both lots of the same age received an equal amount in each case. One lot of yearlings and 1 lot of 2-year-olds received as roughage, straw and 20 lbs. of silage per day, while the comparative lots received straw only. At the start of the test the lots of yearlings averaged 764 and 750 and the 2-year-olds 1,062 and 1,082 lbs. in weight.

In the 159 days of the test the yearlings and 2-year-olds receiving silage made average daily gains of 1.5 lbs. each. The other lot of yearlings gained 1.4 lbs. per steer daily and the 2-year-olds 1.1 lbs. It required 4.8 and 5.3 lbs. of grain to produce 1 lb. of gain by the yearlings with and without silage, respectively, and 6.3 and 8.2 lbs. of grain were required to produce 1 lb. of gain by the respective lots of 2-year-olds.



To determine the effect of dehorning on steers when placed in the feed lot, 35 steers were dehorned, and their gains during the first month and during the feeding period were compared with the gains of 17 hornless steers. The dehorned steers gained an average of 32.6 lbs. per steer during the first month and 186.3 lbs. during the feeding period, whereas the hornless steers gained an average of 59.9 lbs. per steer during the first month and 231.1 lbs. during the feeding period.

**Sheep feeding.**—**XII, Fattening western lambs, 1922-23, J. H. SKINNER and F. G. KING** (*Indiana Sta. Bul.* 273 (1923), pp. 13).—In continuation of the lamb feeding trials previously noted (*E. S. R.*, 48, p. 268), comparisons were made between soy beans, soy bean oil meal, and cottonseed meal; ear corn and shelled corn; corn silage and corn stover; and self-feeding and hand-feeding. This experiment was carried on much as the previous ones, with 8 lots of 25 lambs, each averaging about 64 lbs. The mixed grains and the roughage were fed twice daily except where self-feeders were used.

The rations and the average daily gains per lamb during the 70-day feeding period on each ration were as follows: Shelled corn, soy bean oil meal, corn silage, and clover hay 0.378 lb.; shelled corn, whole soy beans, corn silage, and clover hay 0.403 lbs.; shelled corn, whole soy beans, mineral mixture, corn silage, and clover hay 0.394 lb.; shelled corn (self-fed), cottonseed meal, corn silage, and clover hay 0.405 lb.; shelled corn (self-fed), cottonseed meal (self-fed), corn silage, and clover hay 0.414 lb.; ear corn, cottonseed meal, corn silage, and clover hay 0.407 lb.; shelled corn, cottonseed meal, corn silage, and clover hay 0.389 lb.; and ear corn, cottonseed meal, corn stover, and clover hay 0.341 lb. The results thus show that soy beans in connection with the feeds employed in these rations have a high feeding value for lambs, the most economical results coming from the lot of lambs receiving the whole soy beans with the addition of a mineral mixture. No advantage was shown for feeding shelled corn in place of ear corn, and the feeding of corn stover is to be discouraged according to these results.

The gains made by the lots receiving corn, self-fed, indicates that self-feeding is practical provided necessary precautions are taken in accustoming the lambs to the self-feeders. The calculated profits per lamb over feed costs were greatest (\$1) in the lot receiving ear corn, cottonseed meal, corn silage, and clover hay, whereas the lot receiving corn stover lost 6 cts. per lamb. The second lowest calculated profit was 73 cts., in the lot receiving soy bean oil meal.

**Care and management of the ewe and lamb, L. J. HORLACHER** (*Ky. Agr. Col. Ext. Circ.* 151 (1923), pp. 15).—This is mainly a discussion of the general principles of sheep breeding, management, and feeding.

**Quality and character of wool, A. R. VAN DER MERWE** (*Union So. Africa Dept. Agr. Jour.*, 6 (1923), No. 3, pp. 237-239).—A discussion of the factors that determine quality in wool, with explanations of why certain characteristics are desirable.

**Thirty-fourth annual wool review, WINCHCOMBE, CARSON, LTD.** (*Sydney: [Authors], 1923, pp. 32*).—A review of wool production in Australia, with special reference to the Sydney and Brisbane markets, is given as in the previous report (*E. S. R.*, 48, p. 70). The meat and fat stock trades are also very briefly summarized.

**[Experiments with swine at the Scott Experimental Station], M. J. TIN-LINE** (*Canada Expt. Farms, Scott (Sask.) Sta. Rpt. Supt. 1922, pp. 13-19*).—Experiments in crossbreeding pigs have been carried on to determine the most efficient breeds for fattening. The crossbred pigs used were from Yorkshire and Berkshire sows sired by Yorkshire, Berkshire, and Duroc-Jersey boars. They

were fed from 10 weeks of age until ready for market (100 days) and their rates of gain and economy of gain compared. The lots received the same ration and the same amounts of feed at the start of the test, but the amount was increased as the pigs seemed to need it. The average daily gains made per pig by the different crossbreds were Yorkshire-Berkshire 1.06 lbs., Berkshire-Yorkshire 0.99, Duroc-Yorkshire 0.84, Duroc-Berkshire 0.71, and by purebred Yorkshires 0.95 lb. The calculated feed costs per pound of gain were 5.25 cts., 5.75, 6.76, 7.69, and 6.04 cts., respectively. The first mentioned breed in the cross denotes the sire used. The following average numbers of pigs per litter have been produced during several years: Purebred Yorkshire 9, purebred Berkshire 4.4, Yorkshire-Berkshire 7.5, Berkshire-Yorkshire 7.6, Duroc-Yorkshire 7.6, and Duroc-Berkshire 10 pigs.

In comparing whole grain and crushed grain for growing pigs, 2 lots of 6 pigs each were selected and fed for 120 days on a ration consisting of 1 part of barley and 3 parts of oats at the start of the test, which was gradually modified until it consisted of equal parts of barley and oats at the end. One lot received whole grain and the other lot crushed grain. Both lots were fed a small amount of oil cake meal near the end of the test. Average gains of 0.7 and 0.85 lb. per pig per day were made by the lots receiving whole and crushed grain, respectively. It required 662 lbs. of whole grain and 541 lbs. of crushed grain to produce 100 lbs. of gain.

In comparing self-feeding and hand-feeding, 1 lot of 6 pigs averaging 43.3 lbs. in weight were hand-fed 3 times a day for 120 days and made average daily gains of 0.85 lb., consuming 541 lbs. of feed per 100 lbs. of gain, whereas the comparative lot receiving the same feed in self-feeders made average daily gains of 1.1 lbs., and required 594 lbs. of feed to produce 100 lbs. of gain.

In a test comparing barley and rye for the growing pigs, 2 lots of 6 pigs each averaging 43.3 lbs. were fed for 120 days on rations of 3 parts of oat chop and 1 part of rye in one lot, and barley in the other at the start of the test. The proportions of barley or rye were gradually increased in each ration to form one-half of them, and a little oil-cake meal was given each lot toward the end of the test. The lot receiving rye made average daily gains of 0.8 lb., consuming 576 lbs. of feed per 100 lbs. of gain. The lot receiving barley made average daily gains of 0.85 lb. and required 541 lbs. of feed to produce 100 lbs. of gain.

To test the value of buttermilk for growing pigs, 1 lot of 6 Yorkshire pigs were fed for 43 days on a ration of oat and barley chop and shorts, and made average gains per pig of 28.6 lbs., as compared with gains of 54.8 lbs. made by a lot of pigs receiving the same ration with the addition of 7 lbs. of buttermilk per pig per day. The buttermilk lot consumed 2.5 lbs. of grain per pound of gain, whereas the other lot consumed 4.7 lbs. Three of the pigs from the buttermilk lot when on rape pasture at the conclusion of this test made average gains of 73 lbs. in 68 days. Three of the pigs from the other lot averaged 69 lbs. gain. The other 3 pigs from each of the 2 lots were fed for 68 days in dry lot without buttermilk. The pigs which had previously received buttermilk averaged 50 lbs. gain, as compared with 37 lbs. for the pigs which had not received buttermilk.

In studying the methods of winter housing for swine, 1 lot of pigs wintered in a warm piggery made gains at practically the same rate, and required approximately an equal amount of feed as pigs wintered in a cheap hog cabin. One pig in the warm house was lost from rheumatism, emphasizing the danger due to the collection of dampness in tight buildings.



The gains made on rape pasture were compared with gains made in dry lot, 2 lots of 6 pigs averaging about 80 lbs. in weight being selected and placed on self-feeders containing 2 parts of oat chop and 1 part of rye chop for 66 days. The lot having access to rape pasture made average daily gains of 1.03 lbs. While the other lot made corresponding gains of 0.618 lb. The respective amounts of feed required to produce 100 lbs. of gain were 550 and 893 lbs.

[**Experiment with sheep at the Scott Experimental Station**], M. J. TINGLE (*Canada Expt. Farms Scott (Sask.) Sta. Rpt. Supt. 1922, pp. 10-12*).—A flock of 36 Shropshire ewes was divided into 3 lots and each lot mated with a ram of different breeding. From 12 ewes a Shropshire ram sired 18, a Cheviot ram 18, and a Rambouillet ram 19 lambs, of which 14, 11, and 15, respectively, were living at 7 months of age. Their respective average weights at this age were 70.1, 79.9, and 79.6 lbs.

In comparing the relative feeding value of sunflower silage, roots, and no succulent feeds for lambs, 3 lots of 13 lambs each averaging from 76.2 to 77 lbs. were selected. All lots received an equal ration of grain (oats 180 parts, barley 90, bran 30, and oil cake meal 18 parts) with oat straw. The average daily gains made in the 71 days of the test were lot 1 0.18, lot 2 0.13, and lot 3 0.1 lb. at estimated feed costs per pound of gain of 8.5, 12.8, and 14.4 cts., respectively. Lot 1 consumed 511 lbs. of silage and 1,750 lbs. of oat straw, and lot 2 consumed 502 lbs. of turnips and 2,625 lbs. of oat straw. The oat straw consumption of lot 3 was the same as that of lot 2.

Four lots of ewes were selected for determining the value of potassium iodid for preventing goiter in lambs. One lot of ewes having access to salt containing 2 per cent of potassium iodid gave birth to heavier and stronger lambs than were produced in the other lots on the same or different rations without potassium iodid in the salt. There was 38 per cent of goiter in the lambs from the lot receiving the same feeds, but none occurred in the lot having access to the potassium iodid and salt mixture.

**Garbage for fattening pigs**, F. S. HULTZ and L. P. REEVE (*Wyoming Sta. Bul. 135 (1923), pp. 19-26, fig. 1*).—The results of the experiments in feeding garbage to pigs, previously noted (E. S. R., 49, p. 470), are reported in more detail, and in addition the results of two other experiments are also given. In one experiment 9 pigs averaging 83 lbs. in weight were fed on garbage alone, gaining an average of 1.6 lbs. per day and consuming 1,309.5 lbs. of garbage per 100 lbs. of gain, at a calculated cost of \$9.17.

Three lots of 10 pigs each averaging 84 lbs. in weight were selected for another experiment. The method of feeding and the feed required to produce 100 lbs. of gain were, respectively, for the different lots, full feed of garbage twice daily 1,336.5 lbs. of garbage; 1 per cent ration of rolled barley and full feed of garbage 103.15 lbs. of barley and 934.44 lbs. of garbage; and the same amount of garbage as fed to the above lot with rolled barley and tankage self-fed 898.63 lbs. of garbage, 112.51 lbs. of barley, and 14.9 lbs. of tankage. The average daily gains per pig were 1.33 lbs. in each of the first two lots and 1.34 lbs. in the last lot. The calculated profits per pig were 17 cts. on garbage alone, \$1.92 on garbage and barley, and \$1.45 on garbage, barley, and tankage.

**A pig feeding experiment (indoor v. outdoor feeding)**, W. G. R. PATERSON (*Highland and Agr. Soc. Scot. Trans., 5. ser., 35 (1923), pp. 43-53, figs. 2*).—In comparing outdoor and indoor feeding at the West of Scotland Agricultural College, two lots of 8 pigs each were selected and fed on the same ration, lot 1 being in dry lot and lot 2 on pasture. The pigs in both lots average about 27 lbs. at the start of the test on June 6. During 14 weeks the pigs fed inside made average gains of 111 lbs., and those on pasture of only 64 lbs.



The author attributes the poor showing of the outdoor lot to two possible causes: (1) The unusually cold weather and (2) the fact that the pigs were not raised out of doors. During a final 4 weeks' finishing period during which both lots were fed inside, lot 1 made average gains of 41.2 and lot 2 of only 34 lbs. The indoor fed pigs were much more economical producers of meat than the outdoor fed pigs in both tests. The dressing percentages of the two lots were nearly the same, but it required 7 weeks longer to get the outdoor lot ready for killing.

**Experiments in fattening suckling pigs with clover weed seeds, B. E. KONDYREFF** (*Izvy Petrovsk. Selsk. Khoz. Akad. (Ann. Acad. Agron. Petrovsk.)*, 1919, No. 1-4, pp. 34-59, pls. 4).—Experiments in fattening 2 to 2.5 months old pigs with clover weed seeds are reported from the Petrovsky Agricultural Academy, Moscow. The pigs were fed for 3 months on potatoes, barley, and varying amounts of weed seeds separated in refining clover seed. The results showed that the feed containing a great proportion of weed seeds was not satisfactory. The pigs were not healthy, and their growth was retarded. Barley combined with potatoes gave the best results, but was considerably more expensive than weed seeds mixed with equal amounts of barley (calculated for starch equivalent). This mixture was good in all respects.

The cost of feed per pound of gain was about 6 cts. for the barley group and 4.5 cts. for the groups receiving weed seeds and the mixed ration.

**A critical histological investigation of the basis of horse breeding in the Serb, Croat, and Slovene Kingdom, I, BLAŽEVAC** (*Versuch einer Historisch-Kritischen Schilderung der Grundlagen der Pferdezeitung im Königreiche der Serben, Kroaten, und Slovenen. Inaug. Diss., Univ. Bern, 1922, pp. 91*).—This is an account of an investigation into the history and development of horses in Yugoslavia, with suggestions of methods for improving the present horses. A bibliography of 111 references is appended.

**Breaking and training colts, V. G. STAMBAUGH** (*U. S. Dept. Agr., Farmers' Bul. 1368 (1923), pp. II+21, figs. 16*).—This revision of Farmers' Bulletin 667 (E. S. R., 33, p. 271) has been made by J. O. Williams and E. B. Krantz.

**Growing experimental chickens in confinement, C. A. HERRICK, J. E. ACKERT, and B. L. DANHEIM** (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 11, pp. 451-455, pls. 2).—Chicks raised in confinement at the Kansas Experiment Station on rations of cereals, bone ash, and green alfalfa were found to develop leg weakness in from 8 to 10 weeks. The use of well lighted pens with clean straw litter and the supplying of a diet of common grains, a dry mash, green feed, skim milk, oyster shells, charcoal, and water has been found to prevent the condition except in the fall of 1920. Insufficient litter and overcrowding seem to reduce the activity of the chicks, resulting in a perverted appetite and leg weakness. Ample light, ventilation, cleanliness, and proper rations must also be supplied.

[**Poultry experiments at the Scott Experimental Station**], M. J. TINLINE (*Canada Expt. Farms, Scott (Sask.) Sta. Rpt. Supt. 1922, pp. 82, 83, 84-87, fig. 1*).—In comparing egg production of pullets and hens at the station, pullets have averaged 11 eggs per month during the year and 7.2 eggs per month during the five winter months as compared with 6.9 eggs per month for the hens' annual production and 2.9 eggs per month for their winter production.

In testing pullets' and hens' eggs for hatching, it was found that 93.2 per cent of the hens' eggs and 90.6 per cent of the pullets' eggs were fertile, of which 63.4 and 50 per cent, respectively, hatched. The death rate of chicks hatched from pullets' eggs was nearly double the death rate of chicks hatched from hens' eggs.

In a test of the different makes of incubators, the following hatching percentages of fertile eggs were obtained: Buckeye 47.2, Prairie State 49.9, Tamlin 61.6, Queens 64, and similar eggs hatched by hens 52.4. The Queens incubator and the hens were only used for late hatches, and the results may have been correspondingly affected.



The time of hatching has been found to have a marked effect on the hatchability of fertile eggs, as during April 43 per cent hatched, during May 53.3 per cent, and during June 68.2 per cent. Approximately 90 per cent of the eggs were fertile in each month.

In a test of the comparative value of beef scrap and skim milk for egg production, pullets receiving beef scrap laid an average of 25 eggs during the winter, while those receiving skim milk averaged 36 eggs for their winter production. The calculated costs per dozen eggs were, respectively, 24.4 and 20.5 cts.

Records of the cost of raising chicks to November 1, exclusive of the cost of eggs and labor, show that the expenses were \$18.14 for kerosene for the incubators, \$28.50 for coal for the brooders, and \$99.96 for feed, or a total cost of \$146.60, from which should be deducted \$70.83 which was received for broilers and cockerels sold. The stock on hand November 1 consisted of 140 choice pullets, 46 choice cockerels, and 41 inferior birds.

In comparing different rations for crate fattening, 5 lots of Barred Rock cockerels made average gains on different rations during a 10-day fattening period as follows: Ground peas, oats, corn, and milk 12.8 oz., ground hull-less oats and milk 9.3, ground rye, oats, and milk, 9.3, ground barley, oats, and milk 9, and crushed oats and milk 6 oz. Another lot receiving free range with dry mash and whole grain made average gains of 6.3 oz.

A comparison of home prepared mash with several more expensive commercial mashes resulted in average egg production during 4 months of 36 eggs when the home-prepared mash was fed and 30 eggs when the commercial mash was fed. The home-prepared mash consisted of oat chop, barley, wheat, bran, and shorts in the proportions of 30:15:7.5:20:10 during the first 3 months of the test, and during the fourth month the ration consisted of oat chop, pea meal, corn, shorts, bran, and beef scrap in the proportions of 4:1:1:1:1:1.

**Does the chick require the fat-soluble vitamins?** A. D. EMMETT and G. PEACOCK (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 679-693, figs. 7).—In testing the vitamin requirement of White Leghorn chicks, different lots of chicks varying in age from 24 to 77 days were fed on complete synthetic diets and on synthetic diets lacking vitamin A or vitamin B, and on a ration of white milled rice only which lacked both vitamins A and B. The presence or absence of vitamin C in the control ration seemed to have practically no effect on growth, but when the diet lacking vitamin B was fed 91 per cent of the chicks developed beriberi, and of those that died 24 per cent showed the presence of urates upon examination. When the diet lacking vitamin A was fed, 11 per cent developed rickets, 83 per cent showed ophthalmia, and of those that died 77 per cent showed urates.

The feeding of the white milled rice lacking both vitamins A and B produced chicks of which 10 per cent showed rickets, 52 per cent ophthalmia, and 50 per cent beriberi, and in 66 per cent of those that died accumulations of urates were observed. Of 126 chicks receiving a diet lacking vitamin A which showed ophthalmia, 63 were cured by administering preparations containing vitamin A. The authors conclude that young chicks require the fat-soluble vitamin for normal growth, and that young chicks suffer more from a deficiency of vitamin A than older ones.

**Feeding for egg production**, L. E. CARD (*Illinois Sta. Circ.* 275 (1923), pp. 12, figs. 5).—The general principles of feeding for egg production are discussed.

**Feeding for egg production**, E. C. FOREMAN (*Mich. Agr. Col. Ext. Bul.* 28 (1923), pp. [4], fig. 1).—The principles of feeding for egg production are briefly noted, and rations are suggested.

**A method of judging fowls for egg production** (*Ariz. Agr. Col. Ext. Circ.* 45 (1923), pp. 7, figs. 2).—The principal characteristics indicating egg production in fowls are presented as formulated by representatives of the poultry departments of several agricultural experiment stations.



The variation of eggs in the rate at which they lose weight, II, L. C. DUNN (*Poultry Sci.*, 2 (1923), No. 5, pp. 166-171).—In continuing the series of studies of the rate at which eggs lose weight (*E. S. R.*, 48, p. 768), a study of the effect of egg size on loss of weight is reported.

The coefficient of correlation between the fresh weights and the percentage of weight lost by normal fertile eggs during 7 days of incubation was  $-0.331 \pm 0.04$ . A correlation between fresh weight and percentage of weight lost by infertile eggs during 20 days' storage at  $50^{\circ}$  F. was  $-0.357 \pm 0.068$ . A coefficient of only  $+0.187 \pm 0.044$  was calculated between the fresh weight and the absolute loss of weight in incubated eggs. Calculations show that with the heavier eggs the surface is less in proportion to the weight than with lighter eggs. To determine the possibility of any variation in the texture of the shell of large and small eggs, the weight lost per unit of surface during 20 days' storage was correlated with the fresh weight of the egg, and a coefficient of  $-0.226 \pm 0.074$  was obtained. All eggs with abnormal shells were discarded, and the surface area was calculated by the formula previously noted (*E. S. R.*, 49, p. 274).

The author concludes that the relationship between the size of the egg and the rate of evaporation is due to the fact that larger eggs have less proportionate surface area and their shells are more impervious. Estimates indicate that the latter condition is a little more important than the former in reducing the amount of evaporation from the larger eggs.

Temperature experiments during the incubation of hen eggs, A. G. PHILIPS and F. D. BROOKS (*Indiana Sta. Bul.* 275 (1923), pp. 16, figs. 5).—The results of a continuation of the experiments dealing with the temperatures of incubation of hen eggs, previously noted (*E. S. R.*, 36, p. 770), are reported. A study of the relative temperatures of the standing and hanging thermometers showed that the differences between the two were somewhat dependent upon the temperature of the operating room. The difference between these thermometers was also found to decrease as the period of incubation progressed.

Based on a summary of all the trials, the percentage of dead germs, based on fertile eggs, did not seem to bear any direct relation to the temperature of incubation, the smallest percentage occurring in white eggs at an incubation temperature of  $102-103-104^{\circ}$  F. and in brown eggs at  $100-101-102^{\circ}$ . The temperatures producing the smallest number of dead in the shell and the smallest total mortality of embryos were for white eggs  $102^{\circ}$  and for brown eggs  $101^{\circ}$  throughout the incubation period. The authors, therefore, conclude that the optimum temperature for incubation is between  $100$  and  $103^{\circ}$ . Lower or higher temperatures than this were equally disastrous. The following table gives a summary of the results obtained in all the trials at the different temperature limits for white and brown eggs:

*Summary of the hatching percentages of all experiments at different incubation temperatures.*

Incubating temperature.	Number of eggs set		Percentage of total eggs infertile.		Percentage of fertile eggs showing dead germs.		Percentage of fertile eggs dying in shell.		Percentage of fertile eggs hatched.	
	White.	Brown.	White.	Brown.	White.	Brown.	White.	Brown.	White.	Brown.
$100^{\circ}$ F. or below.....	975	975	13.02	10.15	11.80	14.61	27.74	32.30	60.44	53.08
Above $100^{\circ}$ F. and below $103^{\circ}$ F.....	1,720	1,724	6.27	12.70	8.06	14.41	13.08	21.39	78.84	64.18
Over $103^{\circ}$ F.....	815	825	6.99	12.12	8.31	18.06	31.66	34.06	60.02	47.86



Other data indicated that the eggs of some hens hatch best at definite temperatures, but that the bulk of the flock showed no consistent preference for any one temperature. The losses in weight were practically the same for brown and white eggs during incubation, but the lower temperatures produced slightly less evaporation. In 1921 the brown eggs used for the tests were slightly heavier than the white eggs and the chicks hatched from them were also slightly heavier, but in 1922 the white eggs (laid by hens) were slightly heavier than the brown eggs (laid by pullets), though the chicks hatched from the brown eggs were slightly heavier.

**Florida poultry production**, N. W. SANBORN (*Fla. Univ. Ext. Bul.* 38 (1923), pp. 27, figs. 14).—Practical directions for poultry production in Florida are given.

**Breeds and management of turkeys**, A. OWEN-JOHN (*Union So. Africa Dept. Agr. Jour.*, 6 (1923), No. 3, pp. 265-272, figs. 4).—The more popular types of turkeys in South Africa are described, with suggestions of methods for breeding, management, feeding, incubation, and marketing.

## DAIRY FARMING—DAIRYING.

[**Dairy cattle experiments at the Agassiz Experimental Farm**], W. H. HICKS (*Canada Expt. Farms, Agassiz (B. C.) Farm, Rpt. Supt.* 1922, pp. 6-9).—The results of the following feeding experiments with dairy cattle are reported, part of which are in continuation of the studies of silages previously noted (*E. S. R.*, 46, p. 878):

**Sunflower silage v. clover silage.**—In a test conducted during January and February, sunflower silage was compared with clover silage for milk production when fed with a ration of 12 lbs. of grain, 20 lbs. of mangels, and 5 lbs. of clover hay. The cows receiving 45 lbs. of sunflower silage produced an average of 22.42 lbs. of milk and 0.8183 lb. of fat per day at an average cost per 100 lbs. of milk of \$1.79. The cows receiving 45 lbs. of clover silage produced an average of 22.92 lbs. of milk and 0.8732 lb. fat per day at an average cost per 100 lbs. of milk of \$1.92.

**Dried beet pulp v. mangels.**—Two cows were fed for 3 periods of 2 weeks each on rations consisting of 12 lbs. of grain, 60 lbs. of clover silage, and 5 lbs. of mixed hay per day, supplemented by either 15 lbs. of pulped mangels or 6 lbs. of dried beet pulp. The average daily milk production per cow while on mangels was 39.99 lbs. and on beet pulp 41.73 lbs. With mangels at \$5 and beet pulp at \$44 per ton, the cost of 100 lbs. of milk was calculated at \$1.17 when mangels were fed and \$1.25 when beet pulp was substituted.

**Peanut meal v. corn meal.**—A comparison of peanut meal and corn meal for milk production was made with 12 cows during 3 periods of 2 weeks each. The grain ration consisted of oat chop, bran, oil meal, and corn meal in the proportions of 4:3:1:1, except that in the peanut meal period an equal quantity of peanut meal replaced the corn meal. The cows received 12 lbs. of the grain mixture and 40 lbs. of clover silage per day, and in addition they were pastured at night. While receiving peanut meal they averaged 27.24 lbs. of milk and 0.924 lb. of fat per day, and when receiving corn meal they produced 27.84 lbs. of milk and 0.952 lb. of fat per day. With each ration the calculated cost was \$1.25 per 100 lbs. of milk.

**Sunflower silage v. corn silage.**—In comparing corn and sunflower silage for milk production, 10 cows were fed daily rations of 12 lbs. of grain and 75 lbs. (when sunflower silage was used or 80 lbs. with corn silage) of a mixture composed of 500 lbs. of sunflower or corn silage, 200 lbs. of pulped mangels, and 100 lbs. of cut mixed hay. When sunflower silage was fed the cows produced

an average of 23.62 lbs. of milk and 0.79 lb. of fat per day at a calculated cost of \$1.87 per 100 lbs. of milk. When corn silage was substituted in the ration they produced an average of 26.14 lbs. of milk and 0.83 lb. of fat at a calculated cost of \$1.75 per 100 lbs. of milk.

**River Ridge experiments with artichokes,** J. C. SIBLEY (*Jersey Bul. and Dairy World*, 42 (1923), No. 31, pp. 1597, 1598, figs. 2).—By feeding the green stalks of the Mammoth French White artichoke (E. S. R., 48, p. 265) to the author's dairy herd during July, August, and September a relatively higher summer milk flow was maintained than was previously found possible in nearly 50 years of dairying. Artichoke silage and cut tubers have also been found to be satisfactory winter feeds.

**Effect of feeding green alfalfa and green corn on flavor and odor of milk,** C. J. BABCOCK (*U. S. Dept. Agr. Bul. 1190* (1923), pp. 12, figs. 3).—Continuing previous work with silage (E. S. R., 48, p. 79), the results of experiments to determine the effect of feeding different amounts of green alfalfa and green corn on the flavor and odor of milk are reported. Jersey and Holstein cows in various stages of lactation were divided into groups of two each, and the test feeds were fed to the different groups for periods of five days, after which no alfalfa was fed for two days. The animals in the different groups were then rearranged and the experiment repeated. In addition to the green alfalfa or green corn fed, in each case a basal ration consisting of a mixture of several grains and cured alfalfa hay was also supplied. The samples of milk from each cow were judged for the presence of off flavors or odors, the percentage of the samples from cows receiving different amounts of green feeds and at different times before or after milking being classified in the following table according to the normal or degree of undesirability of the flavor:

*Classification of opinions of the flavor and odor of samples of milk from cows receiving green alfalfa and green corn in addition to a basic ration.*

Method of feeding.	Flavor.				Odor.			
	Normal.	Very slightly off.	Slightly off.	Off.	Normal.	Very slightly off.	Slightly off.	Off.
	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Check ration for green alfalfa.....	90.30	8.20	1.20 <sup>1</sup>	0.30	88.7	6.7	4.3	0.3
15 lbs. of green alfalfa 1 hour before milking.....	27.00	12.70	29.90	30.40	25.4	9.8	24.9	39.9
30 lbs. of green alfalfa 1 hour before milking.....	16.10	7.90	27.10	48.90	13.8	7.1	21.9	57.2
15 lbs. of green alfalfa immediately after milking.....	93.60	3.40	1.70	1.30	92.3	5.6	1.3	.8
30 lbs. of green alfalfa immediately after milking.....	98.35	.55	.55	.55	97.8	1.7	.0	.5
30 lbs. of green alfalfa 3 hours before milking.....	23.40	21.30	30.80	24.50	22.4	14.9	30.8	31.9
30 lbs. of green alfalfa 5 hours before milking.....	88.70	2.80	7.60	.90	87.7	2.8	5.7	3.8
Check ration for green corn.....	92.50	7.50	.00	.00	93.8	3.7	2.5	.0
25 lbs. of green corn 1 hour before milking.....	79.40	14.00	6.60	.00	86.0	5.6	8.4	.0
25 lbs. of green corn immediately after milking.....	89.80	7.10	3.10	.00	91.8	5.1	3.1	.0

The author concluded from the results that the feeding of from 15 to 30 lbs. of green alfalfa 1 to 3 hours before milking produced objectionable flavors and odors, but proper aeration in one test was found to materially reduce them. Feeding the green alfalfa five hours before milking or immediately after milking, however, had no effect on the flavor of the milk. Feeding green corn one



hour before milking produced only slight off flavors and odors, which would probably not be noticed by the average consumer.

Effect of feeding turnips on the flavor and odor of milk, C. J. BABCOCK (*U. S. Dept. Agr. Bul. 1208 (1923), pp. 8, figs. 2*).—To study the effect of the feeding of turnips on the flavor and odor of milk, a test was carried on similar to the one reported above. Four groups of two cows each were selected. One group received only the hay and grain ration, whereas the other groups received in addition 15 lbs. of turnips one hour before milking, 30 lbs. of turnips one hour before milking, and 30 lbs. of turnips immediately after milking. The results of the opinions on the flavors and odors of the samples of the milk produced are given in the following table:

Classification of samples of milk produced by cows receiving turnips.

Kind of feed.	Flavor.				Odor.			
	Normal.	Very slightly off.	Slightly off.	Off.	Normal.	Very slightly off.	Slightly off.	Off.
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Basic ration only .....	97.5	2.5	0.0	0.0	94.0	6.0	0.0	0.0
15 lbs. of turnips 1 hour before milking .....	30.7	29.1	27.2	13.0	24.8	30.3	29.9	15.0
Aerated samples of same .....	51.0	19.5	19.1	10.4	46.6	19.9	20.7	12.8
30 lbs. of turnips 1 hour before milking .....	6.7	25.8	33.3	34.2	4.2	18.7	37.5	39.6
Aerated samples of same .....	28.9	35.7	19.7	15.7	22.9	35.3	23.7	18.1
30 lbs. turnips immediately after milking .....	87.9	6.9	4.3	.9	84.5	8.6	5.2	1.7

The results indicate that feeding turnips at the rate of from 15 to 30 lbs. before milking produces undesirable flavors and odors, but that aeration tends to eliminate some of the undesirable qualities. When 30 lbs. of turnips were fed immediately after milking, little detrimental effect resulted. Cream from the aerated milk produced from cows receiving turnips one hour before milking showed a greater percentage of the more undesirable flavors and odors than the milk from which the cream was skimmed.

Cost of raising calves, W. A. MUNRO (*Canada Expt. Farms Rosthern (Sask.) Sta. Rpt. Supt. 1922, pp. 13, 14*).—Records kept on the feed consumption of 4 heifer calves born in April showed an approximate cost of \$47 to raise a calf to 1 year of age. These calves were fed whole milk for the first 3 months, and skim milk from 3 to 6 months of age. During the first 6 months they also received whole oats, which were left in a box at all times, salt, and hay or green feeds when pasture was not available. During the winter they received mixtures of oats, barley, bran, oil cake, etc., roots and silage, and hay or green feeds.

Dairying in New Zealand and Australia, J. A. RUDDICK (*Canada Dept. Agr. Bul. 34, n. ser. (1923), pp. 33, figs. 23*).—This is a description of the conditions under which milk and its products are produced in New Zealand and Australia, as observed in a recent visit by the author. Data showing the cost and amount of milk and milk products produced in some of the factories are also given.

Streptococci of feces and mouth of cows.—V, Studies of the streptococci, S. H. AYERS and C. S. MUDGE (*Jour. Infect. Diseases, 33 (1923), No. 2, pp. 155-160*).—In continuing the studies of streptococci at the Dairy Division, U. S. D. A. (*E. S. R., 50, p. 279*), the typical streptococcus of cows' feces was found to be *Streptococcus bovis*. Two types were observed, one of which fermented inulin. In describing the cultural characteristics of *S. bovis*, the authors

state "*S. bovis* is characterized by the fermentation of raffinose and often inulin, by the inability to produce carbon dioxide from peptone or dextrose, ammonia from peptone, and lack of power to hydrolyze sodium hippurate. The colonies on blood agar plates seem to present a typical appearance." The application of this information for detecting fecal contamination of milk is noted.

**Lime content of milk and its influence in cheese making**, G. KOESTLER (*Schweiz. Milchztg.*, 49 (1923), Nos. 35, p. [1]; 36, pp. [3, 4]; 37, p. [1]; 38, p. [1]; 39, p. [1]; 40, pp. [3, 4]; 41, p. [3]; 42, pp. [1, 2]; *abs. in Creamery and Milk Plant Mo.*, 12 (1923), No. 7, pp. 42, 43, 50).—The calcium content of milk and the form of the calcium are discussed, as well as the relation which the calcium seems to bear to the coagulation of milk for cheese making. Milk that is unsatisfactory for the manufacture of cheese because of abnormalities in its coagulability is classified into three types. One type seems to be due to an inflammation of the udder caused by certain types of bacteria, but the cause of the other two types has not been determined. The inability of this milk to coagulate is probably not due to any lack of calcium in the milk, but may be related to the compounds with which the calcium is united. The addition of calcium chlorid to certain types of this abnormal milk will remedy the defect, and it will then coagulate normally.

Feeding experiments indicated no relationship between the amount of calcium in the ration and the amount and form in which it is found in the milk.

**How acidity affects the quality of the mix**, R. C. FISHER (*Ice Cream Trade Jour.*, 19 (1923), No. 9, p. 77).—A discussion of the acidity of ice cream mixes and the results of three experiments in freezing mixes of different acidity are given. A mix having an acidity of 0.19 per cent which was homogenized at 3,000 lbs. pressure was reported as smooth and velvety in body and texture, had an overrun of 95 per cent, and the flavor was fresh, delicate, and creamy. Two other mixes containing 0.25 and 0.3 per cent acidity, respectively, were homogenized at 2,500 lbs. pressure. The body and texture in both cases were velvety and overruns of 96 and 93 per cent, respectively, were obtained, but the flavor in both cases, though excellent and fairly good, lacked freshness.

The author states that the assumption that the development of acidity in the ice cream mix is necessary in order to secure the desired overrun and smoothness of body and texture is a theory which has been passed on from the days before homogenizers.

**Studies in sweetened and unsweetened (evaporated) condensed milk**, W. G. SAVAGE and R. F. HUNWICKE (*[Gt. Brit.] Dept. Sci. and Indus. Research, Food Invest. Bd., Spec. Rpt. 13* (1923), pp. VI+103, figs. 2).—Studies of sweetened and unsweetened condensed milk are reported, dealing especially with their bacteriological contents and referring to the methods by which the bacteria may be reduced.

For the study of the sweetened condensed milk, the contents of 95 cans of condensed milk, 10 samples of sugar, 8 cultural plates of the air in condensed milk factories, 12 samples of fresh milk, and 2 samples of deposits from pipes used to convey condensed milk were examined bacteriologically. Various types of organs were found, but yeasts seemed to be the most common causes of spoilage of the sweetened milk, especially where the cans were blown. Practically all the samples seemed to contain micrococci. Many other types of organisms were also present in certain of them.

As a result of the study, it is suggested that the milk to be condensed should be produced and handled in as sanitary a manner as possible, and that the implements and containers with which the milk comes in contact should be



thoroughly sterilized and precautions taken to prevent dust or dirt from getting into the product from the air of the condensery. The necessity of air-tight containers for canning the milk is also emphasized, since the experiments thoroughly demonstrated that the presence of sugar in the condensed milk was not sufficient to prevent bacterial growth, but that the keeping out of air seemed to be the most important single consideration in preserving the milk.

In the study of unsweetened condensed milk, bacteriological examinations of 104 cans of unsweetened condensed milk were made. It was found that 85 per cent of the shop samples and 76 per cent of the factory samples were sterile. Forty-seven of the samples examined were unfit for use, and the cause of the spoilage was determined for 33 of the samples as follows: Sporing anaerobes 3, micrococci 18, coccoidal bacillus type 5, yeast 1, and gas producing aerobic bacilli 6. It may thus be seen that the yeasts are not as important sources of spoilage in unsweetened condensed milk as they were in the sweetened milk. From a practical viewpoint, the authors suggest that the manufacturer has essentially to guard against the survival of nonspore-bearing bacteria, referring especially to the more resistant types of micrococci and the admission of air through minute leaks which may enable dormant forms to multiply and cause decomposition.

## VETERINARY MEDICINE.

**Textbook of clinical diagnosis of the internal diseases of domestic animals**, J. MAREK (*Lehrbuch der Klinischen Diagnostik der Inneren Krankheiten der Haustiere*, Jena: Gustav Fischer, 1922, 2. ed., rev., pp. XII+859, pls. 29, figs. 505).—This revised edition of the work previously noted (E. S. R., 26, p. 677) includes 40 additional figures.

**Special pathological anatomy of domestic animals**, E. JOEST (*Spezielle Pathologische Anatomie der Haustiere*. Berlin: Richard Schoetz, 1921, vol. 2, pt. 2, pp. 465-650, pls. 3, figs. 74).—This second part of volume 2 of the work previously noted (E. S. R., 46, p. 681) deals with the central and the peripheral nervous system.

**Veterinary ophthalmology**, G. SCHLEICH (*Tieraugenheilkunde*. Berlin: Julius Springer, 1922, pp. VIII+239, figs. 3).—This textbook of ophthalmology includes classified bibliographies.

**The anatomy and physiology of capillaries**, A. KROGH (*New Haven: Yale Univ. Press; London: Humphrey Milford*, 1922, pp. XVII+276, figs. 51).—The 16 parts of this work, presented at Yale University as the eighteenth of the series of the Silliman memorial lectures, deal with the subject as follows: Introductory—the distribution and number of capillaries in selected organs; the independent contractility of capillaries; the structure of the capillary wall; the innervation of capillaries; the reactions of capillaries to stimuli; the hormonal control of the capillary circulation; the mechanism of some capillary reactions, especially in the skin of man; the exchange of substances through the capillary wall; and some applications of the physiology of capillaries to complex processes in health and disease. A bibliography of nine pages is included.

**Action of serum on lymphocytes in vitro**, A. CARREL and A. H. EBELING (*Jour. Expt. Med.*, 38 (1923), No. 5, pp. 513-519, pls. 2, fig. 1).—The authors' conclusions, under the conditions of the experiments reported, are as follows:

"Lymphocytes and large mononuclear cells can live and increase greatly in numbers in blood serum, while fibroblasts are not capable of doing so. While

living in serum, lymphocytes and large mononuclear cells manufacture and secrete substances which may be used as food material by the fibroblasts. It is probable that lymphocytes and large mononuclear cells synthesize from the nitrogenous compounds contained in serum the substances which fibroblasts and epithelial cells require for their multiplication."

**The correlation between the chemical composition of anthelmintics and their therapeutic values in connection with the hookworm inquiry in the Madras Presidency.**—XX, Carbon tetrachlorid, J. F. CAIUS and K. S. MHASKAR (*Indian Jour. Med. Research*, 11 (1923), No. 2, pp. 347-351).—Reporting upon studies of carbon tetrachlorid, the authors conclude that it is a powerful vermicide for hookworms, acting equally well on ankylostomes and necators, but that no positive conclusions as to the safety of the treatment can be reached until a large number of tests are repeated.

**The correlation between the chemical composition of anthelmintics and their therapeutic values in connection with the hookworm inquiry in the Madras Presidency.**—XXII, Summary and conclusions, J. F. CAIUS and K. S. MHASKAR (*Indian Jour. Med. Research*, 11 (1923), No. 2, pp. 371-375).—The authors' studies have led to the following conclusions:

"Carbon tetrachlorid, thymol, betanaphthol, and ascaridol (oil of chenopodium) were found to be most effective against hookworms and equally efficacious. The four substances are carbon compounds of simple molecular composition and structure. If taken individually it may be proved that the therapeutic value of the substance is correlated with some particular grouping or structure in the molecule—the cumulative effect of the halogen atoms in carbon tetrachlorid, the free phenolic hydroxyl group in thymol and betanaphthol, the peroxid structure in ascaridol. However, the four compounds differ so very much in molecular composition and structure that no general correlation can be said to exist between anthelmintic properties and chemical composition or structure. Anthelmintic action on hookworms is, therefore, specific."

**Notes on ascaricides**, J. F. CAIUS and K. S. MHASKAR (*Indian Jour. Med. Research*, 11 (1923), No. 2, pp. 377-392).—In studying the relative efficacy of various drugs in expelling roundworms, it was found that santonin is the most efficient, and that chenopodium oil, betanaphthol, thymol, and carbon tetrachlorid have ascaricidal properties. Of the Indian anthelmintics only one, *Butea frondosa*, removes roundworms, and its efficiency does not compare favorably with any of the above-mentioned drugs.

Santonin was found to have no vermifugal action and to be a poor vermicide. Seven santonin derivatives were prepared and their respective anthelmintic power compared with that of santonin. It is concluded that the lactone group in santonin has no bearing on its anthelmintic action.

**Foot-and-mouth disease and its control**, [T.] KITT (*Landw. Hefte*, No. 49-50 (1922), pp. 45, figs. 6).—This is a summary of information on the knowledge of this disease and means for its control.

**Bird migration and the introduction of foot-and-mouth disease**, S. STOCKMAN and M. GARNETT (*Jour. Min. Agr. [Gt. Brit.]*, 30 (1923), No. 8, pp. 681-695, pls. 6; also in *Vet. Rec.*, 3 (1923), No. 50, pp. 903-913, figs. 6).—This is a report of further investigations (*E. S. R.*, 45, p. 281) of bird migrations as the source of the outbreaks of foot-and-mouth disease in Great Britain.

The authors find that there are most remarkable relations, both as regards seasons and localities, between the movements of birds and the initial outbreaks of the disease. "Some of these outbreaks, however, do not correspond with what are believed to be the known facts as regards bird movement. On



the other hand, these facts are admittedly incomplete, and the circumstantial evidence as a whole is very far short of being able to establish a negative."

**Dead bacilli and tuberculin reactions**, E. COULAUD (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 33, pp. 1023, 1024).—The author reports that the sensitiveness to tuberculin produced in rabbits by the intravenous injection of dead tubercle bacilli depends not so much on the size of the dose as on the extent of the lesions produced, these being greater the less homogenous the suspensions used for inoculation.

**Avian type of tuberculosis in cattle: Injection and testing**, C. ELDER and A. M. LEE (*Wyoming Sta. Bul.* 136 (1923), pp. 29-41, figs. 3).—In this experimental study of the possibility of infecting cattle with avian tubercle bacilli, range yearling steers which had given negative ophthalmic, intradermal, and subcutaneous tuberculin tests were injected, two intradermally with 0.1 and 0.2 cc., two subcutaneously with 1 and 2 cc., and two intramuscularly with 1 and 2 cc. of a pure culture of avian tubercle bacilli proved virulent by control experiments with chickens. Four animals were left uninjected as controls.

Four months after the injection, the two animals injected subcutaneously and one of the two injected intramuscularly showed nodules at the site of injection. All of the animals were given the three tuberculin tests (ophthalmic, intradermal, and subcutaneous), using B. A. I. tuberculin. Positive and suspicious intradermal reactions were given by the animals which had developed local lesions, but no reaction to the ophthalmic test was obtained, and the rise of temperature following the subcutaneous test was too slight to be considered a positive reaction.

It is concluded that cattle can be infected with avian tubercle bacilli when injected subcutaneously or intramuscularly in comparatively large doses, and that the intradermal test is the most reliable of the three for detecting tuberculosis in cattle when infected with avian tubercle bacilli.

**The dish towel as a source of tuberculous infection**, C. FLOYD and L. SIKORSKY (*Amer. Rev. Tuberculosis*, 7 (1923), No. 2, pp. 117-119).—The possibility of dish towels being a source of tuberculous infection in homes where there are active cases of tuberculosis was studied by the inoculation of guinea pigs with washings of dish towels used by tuberculous patients.

In the series of 25 cases thus examined, no positive results were obtained. Negative results were also obtained in three control experiments in which gauze was thoroughly impregnated with tubercle bacilli and then thoroughly washed, after which tests were made as in the case of the dish towels. It is thought that the most reasonable explanation of these negative results is that any viable tubercle bacilli which might have been caught in the meshes of the dish towel were either killed or weakened by the strong alkali soap or soap powder used in washing the dishes and towels.

**Sterility of the cow and reinversion of the uterus** (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 86-87 (1923), *Spanish ed.*, pp. 3-8, fig. 1).—The first of these two circulars is a popular account of the Sterility of the Cow, by A. Rivera (pp. 3-5), and the second of the Reinversion of the Uterus, by J. Bagué (pp. 7, 8).

**Concerning infectious abortion**, F. A. RICH (*Vermont Sta. Bul.* 231 (1923), pp. 3-32, fig. 1).—The first part of this bulletin (pp. 4-8) reports upon studies of methylene blue, carried on in continuation of the work previously noted (E. S. R., 30, p. 184), it having been used in 4 herds and methylene blue and cresol in 31 herds. The author concludes that there is no indication that the use of either methylene blue or cresol will inhibit all cases of abortion, nor does it even seem certain that their use will tend in that direction. However,



it is concluded that its use was followed by a somewhat lowered percentage of abortion.

The second part of this account (pp. 9-15) reports in detail upon 28 years' experience with the university herd, records of the prevalence of abortion in the herd being presented in tabular form. Part 3 (pp. 16-32) consists of a summary of control measures for the disease, which includes a review of the literature on the subject.

**Some experimental work in hog cholera,** E. W. PORTER (*Jour. Amer. Vet. Med. Assoc.*, 63 (1923), No. 5, pp. 580-590).—Studies of various problems arising in connection with hog cholera control are summarized briefly.

**Samples of antihog-cholera serum** of known potency were kept frozen for periods of 3, 7, and 14 days, respectively, and were then thawed at room temperature and tested in doses corresponding to the protective dose of untreated serum. All of the animals treated with the frozen and subsequently thawed serum remained well, while the control died on the twelfth day of acute cholera. It is concluded that freezing does not alter the potency of antihog-cholera serum.

The possibility of the transmission of hog cholera by fowls was tested by giving several White Leghorn hens access to pens in which were kept 3 virus pigs and 3 susceptible pigs, respectively. As controls 3 pigs receiving no treatment were kept in a pen to which the fowls did not have access, and 1 pig receiving serum as well as virus was placed in the pen containing the virus pigs. All of the controls remained well, while the virus pigs showed elevation of temperature on the fourth day, with loss of appetite and other evidences of infection from the eighth to the ninth day. Two of these animals died on the eleventh and 1 on the seventeenth day. Thirteen days after the appearance of the temperature reaction in the virus pigs, all of the pigs in the exposed pen showed an elevation of temperature, and 2 died on the second and 1 on the third day following. It is concluded that chickens, at least when confined in close quarters, may be an important factor in the transmission of hog cholera.

The relative virulence of whole and clarified hog-cholera blood at different periods of from 9 to 139 days after carbolization was tested by duplicate series of experiments with susceptible young pigs. No loss in the activity of the virus was noted up to a carbolization period of 139 days. Whole blood virus treated for this length of time was still active, but clarified blood was inactive. A further proof that clarified virus is efficient as an immunizing agent was afforded by the results reported of the hyperimmunization of 212 hogs previously immunized with 2 cc. of clarified virus and from 30 to 50 cc. of serum. These animals were hyperimmunized by the intravenous injection of virulent cholera blood at the rate of 5 cc. per pound of body weight. The length of time intervening between the immunization and hyperimmunization was from 5 months and 7 days to 8 months and 24 days. None of the animals developed even a temperature reaction.

The possibility of producing active immunity to hog-cholera by the administration of virus alone at varying intervals after serum-alone treatment was tested by giving each of 24 shotes, averaging about 50 lbs. in weight, an intra-abdominal injection of 40 cc. of clear serum. Once each week for 6 weeks thereafter one lot of 4 pigs was given an injection of 2 cc. of hog-cholera virus. With one exception all of the animals remained well up to and including the fifth week, while all receiving the virus on the sixth week showed an elevation of temperature on the fourth day and loss of appetite on the sixth day. Five weeks thus appeared to be the duration of the passive



immunity secured by serum alone. The active immunity resulting from the inoculation of virus remained absolute for at least 7 months.

The value of antihog-cholera serum as a curative agent was tested on 16 susceptible pigs averaging about 40 lbs. in weight, all of which were infected on the same day. In one lot 3 were used as virus controls, and 3 were given protective doses of serum simultaneously with the virus. In another lot 2 were used as controls and 3 given curative doses of serum at the first rise in temperature, and in a third lot 2 were used as controls and 3 given curative doses of serum at the first physical evidence of infection. All of the control animals sickened and died. The serum animals in the first lot showed temperature reactions but no other evidences of infection. The animals in the second lot, which were treated on the fourth day after receiving virus, developed typical cholera temperatures, with slight temporary loss of appetite, but made complete recoveries. The serum animals in the third lot, which were treated on the sixth day, did not respond to treatment and died on the fifteenth and sixteenth days. It is concluded that antihog-cholera serum has curative value when used in the initial stages of infection, but is of no value if administered after physical evidences of infection have appeared.

**Glanders and bovine infectious abortion complement fixing antibodies in two apparently normal horses,** F. BOERNER, JR. (*Jour. Amer. Vet. Med. Assoc.*, 63 (1923), No. 5, pp. 591-593).—In the course of conducting complement fixation and intradermal mallein tests for glanders on about 2,000 horses in the city of Philadelphia, 2 horses were found which reacted to the complement fixation but not to the mallein test. Negative results were obtained with both animals with the intradermal test applied to the other eye and with the ophthalmic test. Repeated complement fixation tests with several antigens of *Bacillus mallei* were positive. Positive reactions were also obtained with the sera of both animals when tested with several antigens of *Bacterium abortus*. The specificity of the reaction to both antigens was further proved by anticomplementary and absorption tests. Negative results were obtained with antigens prepared from *B. typhosum*, *Bacillus tuberculosis*, pneumococci, and gonococci. Both animals were killed, but on autopsy showed no lesions of glanders or scar tissue indicating healed lesions.

In discussing the significance of these results, the possibility is suggested that the complement fixing antibodies found in both horses were of the nature of natural or native hemolytic amboceptors.

**Vitamins and their relation to poultry diseases,** F. R. BEAUDETTE (*New Jersey Stas. Hints to Poultrymen*, 12 (1923), No. 2, pp. 4, figs. 2).—This is a brief popular account of vitamins in which their relation to disease is pointed out.

**Control of bacillary white diarrhea, 1922-23,** G. E. GAGE and O. S. FLINT (*Massachusetts Sta. Control Ser. Bul.* 23 (1923), pp. 10, fig. 1).—This is a report in continuation during 1922-23 (*E. S. R.*, 48, p. 778) of control work with bacillary white diarrhea. It is pointed out that the work is centered around the attempt to establish disease-free flocks from which day-old chicks and hatching eggs may be obtained. During the year the blood of 33,602 breeding hens was examined by the macroscopic agglutination test, of which 7.6 per cent reacted. As a result of the work, 29 poultry plants in the State were found to be free from the disease. The livability of chicks furnished to poultry farms from bacillary white diarrhea free flocks was increased from about 15 to 20 per cent to an average of over 90 per cent.

**Clostridium botulinum type C, a pathogenic anaerobe associated with a limberneck-like disease in chickens and ducks,** R. GRAHAM and I. B. BOUGHTON (*Illinois Sta. Bul.* 246 (1923), pp. 3-34, figs. 9).—From a number of cases of



limberneck occurring spontaneously among chickens in different parts of the State, an organism has been isolated which appears to be identical with *C. botulinum* type C isolated from the larvae of *Lucilia caesar* by Bengtson (E. S. R., 47, p. 258) and the anaerobe isolated from bovine cases of bulbar paralysis by Seddon (E. S. R., 48, p. 181). A detailed report is given of the studies conducted on 11 specimens obtained from 4 of these outbreaks. The history, clinical symptoms, gross pathology, and bacteriological findings are given for each case with a description of the cultural characteristics of the organism when grown in pure culture.

The chief cultural characteristics differentiating *C. botulinum* type C from types A and B are summarized in the following table:

*Cultural characters differentiating C. botulinum types A and B from type C and parobotulinus of Seddon.*

Medium or characteristic.	<i>C. botulinum</i> types A and B.	<i>C. botulinum</i> type C or parobotulinus (Seddon).
Glucose agar.....	Gas.....	No gas.
Do.....	Disc colonies.....	Branching colonies.
Glucose broth.....	Even cloudiness.....	Flocculent growth.
Do.....	Acid and gas.....	Acid.
Meat mash.....	Very fine gas bubbles on surface.....	Gas bubbles large and along sides of tube.
Milk.....	No change.....	Acid.
Motility.....	Motile under cover glass.....	Nonmotile under cover glass.
Spores.....	Resistant to heat.....	Nonresistant to heat.

In the affected flocks thus far observed, type C botulism appeared to be less fatal than type A. Weakness of the cervical muscles was not so frequently noted as in type A outbreaks, and healthy chicks and other animals were less susceptible to filtered and unfiltered cultures of type C than of type A. When subcutaneously injected, both unfiltered and filtered cultures were more quickly fatal to horses, cattle, and sheep than when fed. Chickens of low vitality, suffering from contagious epithelioma, proved much more susceptible to type C toxin than did healthy fowls.

An antitoxin prepared from goats and calves by repeated injection of the culture filtrate of *C. botulinum* type C has proved of prophylactic value for guinea pigs and appears to be useful in identifying the toxin in immunologic tests where the type C organism is suspected. It has not been tested sufficiently to determine whether it is of value in the treatment or prevention of type C poisoning in poultry and other animals.

The organism was found in the soil of two poultry yards several months after an outbreak of disease in the chickens on the premises and also in the soil of a barnyard where horses had died of a paralytic disease. That the toxin can be formed in feeds is demonstrated by its development in shelled corn inoculated with toxin-free spores and sealed in glass bottles. Other feeds and soils similarly inoculated, however, gave no positive tests.

RURAL ENGINEERING.

The economical use of irrigation water based on tests, H. S. CLYDE, W. GARDNER, and O. W. ISRAELSEN (*Engin. News-Rec.*, 91 (1923), No. 14, pp. 548-552, figs. 6).—In a contribution from the Utah Experiment Station, a mathematical method of interpreting irrigation experiments and of determining the economical use of irrigation water under various conditions of water supply, irrigable land, cost of crop production, and value of crops produced is presented and discussed, based on the results of typical experiments in California, Idaho, and Utah. The method is applied where water is available



at a given price, where there is a large area to be irrigated and a limited water supply available, and where an area is partly dry farmed and partly irrigated.

**The H-ion concentration of a creek, its waterfall, swamp, and ponds,** R. P. COWLES and A. M. SCHWITALLA (*Ecology*, 4 (1923), No. 4, pp. 402-416, figs. 3).—Studies are reported which showed that the various sections of a creek situated on the campus of Johns Hopkins University showed decided differences in pH values. In ponds the pH was modified by the aquatic fauna and flora, although under certain conditions ponds maintained a practically constant pH. The pH of water flowing slowly over decaying vegetable matter was lowered, but when water flowed rapidly over a clean bed, most noticeably at falls and rapids, the pH was raised. This is considered to be a probable result of aeration.

The results are taken to indicate that in this creek the free carbon-dioxid content is apparently a determining factor in establishing and maintaining pH values. A marked tendency toward diurnal variation of the pH was observed in certain sections of the creek, this being readily brought into harmony with the variations in the free carbon-dioxid content.

**The development of the West under irrigation,** C. E. GRUNSKY (*Engin. News-Rec.*, 91 (1923), No. 18, pp. 715-718).—This is the second of a series of articles on Federal reclamation of arid lands, in which Government aid in irrigation and the future extension of irrigation are especially discussed.

**Homemade irrigation devices,** H. E. MURDOCK and J. R. BARKER (*Mont. Agr. Col. Ext. [Pub.]* No. 60 (1923), pp. 23, figs. 18).—Homemade irrigation devices for use under Montana conditions, including ridging, ditching, and water diversion apparatus, are described and illustrated and bills of material given.

**Farmers' storage reservoirs, diversion dams, and dikes,** H. E. MURDOCK and B. FERGUSON (*Mont. Agr. Col. Ext. [Pub.]* No. 59 (1923), pp. 18, figs. 12).—Practical information on the planning and construction of farm irrigation structures such as storage reservoirs, diversion dams, and dikes is presented in this publication.

**Installing farm drainage systems,** W. P. MILLER (*Ohio Agr. Col. Ext. Bul.*, 18 (1922-23), No. 10, pp. 26, figs. 16).—Practical information on the installation of farm drainage systems under Ohio conditions is presented in this bulletin.

**Correct methods of farm drainage,** H. B. ROE (*Brick and Clay Rec.*, 63 (1923), Nos. 5, pp. 322-328, figs. 10; 6, pp. 406-412, figs. 14).—In a contribution from the Minnesota Experiment Station, information is presented on how farm lands should be tilled to produce the best drainage results, with emphasis on the structural features of the work.

**Origin, problems, and achievements of Federal land reclamation,** F. H. NEWELL (*Engin. News-Rec.*, 91 (1923), No. 17, pp. 666-673, figs. 4).—This is the first of a series of articles on the history and performance of Federal land reclamation, dealing with the problems and achievements in a broad general sense.

**Extension of construction charges on reclamation projects** (*U. S. House Represent.*, 67 Cong., 4 Sess., *Com. Irrig. Arid Lands Hearings on S. 4187*, pt. 3 (1923), pp. II+47-160+II).—The text of the hearings to extend the time for payment on charges due on reclamation projects and for other purposes is presented.

**The strength of concrete: Its relation to the cement, aggregates, and water,** A. N. TALBOT and F. E. RICHART (*Ill. Univ., Engin. Expt. Sta. Bul.* 137 (1923), pp. 118, figs. 46).—This bulletin reports studies resulting in a statement of relations between the compressive strength of concrete and the amount of the cement and voids contained therein. Methods for studying the concrete-making properties of fine and coarse aggregates and for the comparison and



acceptance of aggregates are developed, and means for designing concrete mixtures for different densities and strengths are outlined. Means are suggested for estimating the effect upon the strength and density of concrete which accompanies an increase in the amount of mixing water beyond that which would give minimum volume. A large amount of data is included.

**Some compressive tests of hollow tile walls,** H. L. WHITTEMORE and B. D. HATHCOCK (*U. S. Dept. Com., Bur. Standards Technol. Paper 238 (1923), pp. 513-527, pl. 1, figs. 5*).—Tests of 32 walls built of hollow tile are reported. The walls were either 6, 8, or 12 in. thick and 4 ft. long by 12 ft. high. About half were built with the cells of the tile vertical and half with the cells horizontal. A few walls of each construction were tested under a load having an eccentricity of 2 in.

Considerable differences in the strengths of the individual tile did not have an appreciable effect upon the strength of the walls. No relation was found between the ultimate strength and the load at first crack.

The stress at failure computed on the net sectional area was remarkably constant for tile on end, being independent of the size of the tile. Walls having the cells of the tile vertical had, on the average, more than twice the strength of those having the cells horizontal. Walls loaded with an eccentricity of 2 in., over one-half the width of the wall, had about one-half the strength of similar walls axially loaded. Apparently this ratio was independent of the thickness of the wall. No relation was established between the modulus of elasticity of the walls and that of the tile.

**Apparatus used in highway research projects in the United States,** C. A. HOGENTOGLER (*Bul. Natl. Research Council, 6 (1923), No. 35, pp. 91, figs. 70*).—This report, prepared by the U. S. D. A. Bureau of Public Roads in cooperation with the Advisory Board on Highway Research of the National Research Council, describes the principle and construction of different devices and apparatus used in various highway research projects in the United States and by the Bureau of Public Roads, and discusses the purpose for which they were designed.

**The use of marl in road construction,** C. H. Dow (*Minn. Univ., Engin. Expt. Sta. Bul. 1 (1923), pp. VIII+67, figs. 71*).—The results of laboratory and field experiments on the use of marl in road construction in the State of Minnesota are reported.

The laboratory experiments showed that marl-sand is a weaker combination than clay-sand. On slaking, the marl-sand did not muddy or discolor the water being practically insoluble. This is taken to indicate that less marl-sand surfacing will wash away in rainy weather than clay-sand. Marl-sand did not long remain suspended in water, and when dry it resisted the penetration of water for a long time. In comparison, clay-sand showed an immediate affinity for water. Marl-sand dried out nearly as slowly as clay-sand, and mixtures thereof were very compressible, retaining their molded shape under pressure.

The field studies of experimental roads, while not conclusive, showed that the marl-sand surface proved entirely satisfactory as a slab to bear up the weight of traffic, and also withstood heavy rains without noticeable injury. Beyond a certain amount of absorption, it seemed to be impervious to water. The application of a uniform coating over the width of the road with a very low crown seemed to be confirmed in principle. The mixture as used was homogeneous and yielded a smooth surface, without waves or chuck holes. After protracted dry weather and under heavy traffic, the surface became very dusty, the dust being somewhat more offensive than the ordinary kinds. Light traffic produced little or no dust even during protracted dry weather.



The results are taken to indicate that for light traffic the surfacing of a sand subgrade with marl-sand is satisfactory from every standpoint, and is a great improvement over the loose sand through which it is built.

**Movable and long-span steel bridges**, G. A. HOOL, W. S. KINNE, ET AL. (*New York and London: McGraw-Hill Book Co., Inc., 1923, pp. XIV+496, pls. 7, figs. 311*).—This volume is one of a series of works on civil engineering and has been compiled by a staff of specialists in subjects relating to movable and long-span steel bridges. It contains sections on bascule bridges, vertical lift bridges, swing bridges, continuous bridges, cantilever bridges, suspension bridges, steel arch bridges, analysis of three-hinged arch bridges, analysis of fixed arches, and analysis of two-hinged arches.

**Experimental production of straw gas**, H. E. ROETHE (*U. S. Dept. Agr. Bul. 1203 (1923), pp. 11, figs. 3*).—This is a brief description of the experimental apparatus and presentation of the results of work conducted at the Arlington, Va., Experiment Station on the production of gas from air-dried wheat straw. The equipment used consisted of a cylindrical steel retort, a steel scrubber and condenser combined, and a steel water-seal gasometer.

It was found that with this apparatus a ton of sun-dried wheat straw gave approximately 10,000 cu. ft. of purified gas, 625 lbs. of carbon residue, 10 gal. of tar, and a large quantity of ammoniacal liquors. This gas had a heating value of about 400 B. t. u. per cubic foot and the straw about 6,000 B. t. u. per pound. The gas was found to burn with a clear blue flame in a Bunsen burner, and produced a very satisfactory light in a mantle lamp. It was also very satisfactory for operating stationary internal-combustion engines, giving the best results when admitted to the explosion chamber with the addition of but little air and ignited under a compression greater than that found in the ordinary type of farm engine. It contains a rather high percentage of poisonous carbon monoxid.

It is estimated that about 300,000 cu. ft. of straw gas would be consumed yearly on the average northern farm as fuel for cooking and lighting purposes in the home, for heating the house, and for heating water. From 45 to 50 tons of dry straw would be needed for the production of 300,000 cu. ft. of purified gas, and, on the basis of an average yield of 1.14 tons of straw per acre of small grains, each farm would thus need from 40 to 45 acres in small grains for the production of gas alone.

The results are taken to indicate that the type of straw-gas-producing plant used is not practicable as a unit for farms, chiefly on account of its initial cost and upkeep, the length of time required to produce suitable quantities of gas, and certain inconvenient features of the retort and scrubber. It is concluded that, while gas produced from straw may be used successfully for lighting and heating and as a motor fuel, apparently the destructive distillation of straw and similar material for the production of gas on the farm is not practicable.

**Benzol as a motor fuel**, A. C. FIELDNER and G. W. JONES (*Chem. and Metall. Engin., 29 (1923), No. 12, p. 543*).—Comparative engine tests with crude, acid refined, and silica gel refined motor benzol, conducted at the Pittsburgh Experiment Station of the U. S. Bureau of Mines, are reported.

The results showed that crude motor benzol can not be used satisfactorily in an internal-combustion engine. Acid refined or silica gel refined benzols developed no engine troubles and were satisfactory for use therein, provided the refining process in either case was complete in removing the gum-forming constituents. Variation in the air-fuel ratio in these tests showed on definite



Influence on the quantity of gummy deposits formed. It is stated that a motor benzol fuel which gives an evaporation residue less than 0.01 per cent by weight should not give gummy depositions in the intake manifold and on the intake valves when used in an internal-combustion engine.

**The application of electricity to agriculture and the household**, L. DE CARTIER D'YVE (*Min. Agr. [Belgium], Admin. Agr. et Hort., Avis Cult. No. 20 (1923), pp. 36, figs. 28*).—General information on the application of electricity to household requirements and to small belt work on Belgian farms is presented.

**A new system of electrical cultivation**, N. FORSSBLAD (*Västerås, Sweden: Västmanlands Allehandas Aktiebolags Tryckeri, 1923, pp. 14, figs. 4*).—A system of cultivation by means of an electric tractor with attached plow and overhead electric cable winding on a drum is described and illustrated. The field is so divided as to reduce as far as possible the distance through which the plow has to be driven along the headlands while keeping the number of guiding ridges as few as possible. An open furrow is left midway between two ridges, and the headlands are plowed last of all.

During a short test the rubber-insulated cable showed no signs of wear, which is taken to indicate that wear from contact with the ground is of small importance. During a long-time test a cable under stress was drawn over the pulleys at the mast and over a part of the cable drum, a distance equivalent to 4,600 miles, without being ruined.

**Agricultural technique and farm engineering in Germany**, S. NUSSBAUM (*Internatl. Rev. Sci. and Pract. Agr. [Rome], n. ser., 1 (1923), No. 1, pp. 49–60, figs. 8*).—Statistical data on the development of farm machines and their uses in Germany are briefly presented. The suggestion is advanced that all agricultural countries should unite to establish a central international office where agricultural and technical experts could investigate the fundamental principles of a systematic application of machinery to agriculture.

**Heat treating in a California tractor plant** (*Amer. Mach., 59 (1923), No. 19, pp. 679–681 figs. 5*).—Information on the equipment used, its capacity, and the work done, and data on the steels and fuels used in the heat treating processes in a tractor plant are briefly presented.

**Tractor and plow usage in the first breaking of peat land**, J. L. LARSON (*Jour. Soc. Automotive Engin., 13 (1923), No. 4, pp. 285–295, figs. 28*).—The substance of this contribution from the Minnesota Experiment Station has been previously noted from another source (*E. S. R., 49, p. 686*).

**The care of farm implements and tools**, L. STEVENSON (*Ontario Dept. Agr. Bul. 300 (1923), pp. 15, figs. 12*).—Information on the proper care of farm implements and tools, with particular reference to protection from the weather is presented in this bulletin.

**Some factors in scientific dairy barn design**, M. A. R. KELLEY and G. L. EDICK (*Agr. Engin., 4 (1923), No. 9, pp. 139–142, figs. 5*).—In a contribution from the U. S. D. A. Bureau of Public Roads, data are presented on sizes of cow stalls, installation of water bowls, and the design of gutters in dairy barns, based on studies conducted in various States.

**Making the old barn new**, J. L. STRAHAN (*Building Age, 45 (1923), No. 10, pp. 66–68, figs. 10*).—In a contribution from the Massachusetts Experiment Station, information on the reconstruction of barns to meet modern farming conditions is presented, together with numerous illustrations and line drawings.

**The pit silo**, J. W. SJOGREN (*Colorado Sta. Bul. 288 (1923), pp. 12, figs. 9*).—This bulletin gives practical information on the construction of a pit silo.



**House insulation and fuel consumption**, H. J. BURT (*Concrete [Detroit]*, 23 (1923), No. 3, pp. 117, 118).—Data on the heat losses through walls and roofs of various types of materials are presented and discussed.

**Notes on the proper placing of the slots in Imhoff tanks**, J. R. DOWNES (*Pub. Works*, 54 (1923), No. 11, pp. 363-365, figs. 4).—A summary of a large amount of data, some of which was obtained at the New Jersey Sewage Experiment Station, is briefly presented. It indicates that the slot of a 2-story tank should be placed with due consideration for the progress of digestion which will have been attained at the time when the fresh solids, without shrinkage, have accumulated to a depth equal to the distance between the hopper and the slot, and that the horizontal dimensions of the tank should be such that the solids will be evenly distributed in so far as possible.

## RURAL ECONOMICS AND SOCIOLOGY.

**The wheat situation**, H. C. WALLACE (*U. S. Dept. Agr.*, 1923, pp. IV+126, figs. 39).—A report is made to the President, in which survey and statistical data are summarized and graphically presented in 87 tables and numerous charts, setting forth the price and purchasing power of wheat, the world bread grain situation, the distribution of the wheat crop of the United States, freight rates as a factor in the wheat situation, Canadian competition in wheat production and the tariff, the financial situation of farmers in the wheat regions, the cost of producing wheat, costs and other factors in the marketing of wheat, and wheat production and agricultural readjustments in the principal wheat regions.

Present low prices are attributed to the large world supply of wheat, for which there is at present not an effective demand. The evidence indicates, moreover, that competition in wheat production will increase very materially; hence, the American farmer must be prepared to meet the competition of foreign producers on the world markets. Taxes, machinery, wages, freight rates, and prices of food and clothing are out of proportion to the price of wheat and the earnings of the wheat farmer.

Fundamental and far-reaching adjustments in production and marketing which farmers themselves must make as a part of a long-time program are discussed. Recommendations are offered with respect to remedial measures which can be instituted by the Government, among them that the War Finance Corporation should make special efforts to finance the exportation of wheat in line with the joint resolution of Congress of January, 1921. To meet the emergency a reduction of at least 25 per cent in interstate freight rates on wheat and wheat products originating in the distressed wheat areas would be helpful, and it is suggested that an effort be made to review the entire structure of interstate railroad rates and make or submit recommendations for adjustments. The partial substitution of taxes based on income in the place of the present property taxes would provide a measure of relief, as would also a further shifting of the cost of good roads to the users of them through taxes on gasoline and motor vehicles. The farmers themselves are urged to adopt methods which will reduce production costs and conserve the cash income, also to produce certain classes of milling wheats that are in special demand. Still another concrete suggestion is that the Government set up an export corporation, the prime duty of which would be to restore, as far as possible, the pre-war ratio between wheat, and other farm products of which we export a surplus, and other commodities.

**A study of the cost of producing wheat and oats in central and southern Indiana**, M. H. OVERTON (*Indiana Sta. Bul.* 272 (1923), pp. 24, figs. 5).—Records were secured on 79 farms having in cultivation 2,170 acres of wheat, on



75 farms having 1,680 acres of threshed oats, and on 8 farms having 45.5 acres of bundle or unthreshed oats in cultivation in Hancock County, Ind. In Washington County records were taken on 81 farms with 1,636 acres of wheat, 45 with 588 acres of threshed oats, and 49 with 426 acres of bundle or unthreshed oats in cultivation. This study is based on records for the one year's harvest, that of 1921.

Wheat cost from \$1.09 to \$4.15 per bushel, and oats from 26 cts. to \$1.87 per bushel in Hancock County. The cost of wheat varied from 90 cts. to \$4.57 per bushel, and that of oats from 31 cts. to \$1.67 per bushel in Washington County. Tabulations are made of the average cost per acre, the range in net cost per bushel, and of various phases of the labor requirements. On an average three times as much man labor and ten times as much horse labor were required to sow an acre of wheat on plowed ground as were required to sow in standing corn, and an increased yield of 5 bu. per acre was secured. Twice as much man and horse labor was required to sow on plowed ground as was required to sow after cut corn, and an increased yield of 1.7 bu. was secured for the extra effort. The amount of labor used per acre was very nearly the same for drilling and broadcasting oats. An increased yield of 5 bu. per acre was secured by drilling.

**A statistical analysis of farm management data,** C. C. TAYLOR (*Jour. Farm Econ.*, 5 (1923), No. 3, pp. 153-162, fig. 1).—A set of gross and net correlations between labor earnings and acres operated, months of labor, the value of working capital, and the value of buildings are worked out, and a number of coefficients of correlation are reached for 237 farms in Tama County, Iowa, in 1921.

It is concluded that increasing the size of the business in the direction of land at costs and prices prevailing in 1921 decreased labor earnings about \$5 with each acre; that increasing size in the direction of labor decreased labor earnings about \$63 for each month; that expanding the hog enterprise increased labor earnings nearly \$44 for each added sow; that every 100 lbs. of dead hogs decreased labor earnings about \$12.50, a sum which is greater than the value of the hogs due to inferior hogs remaining, the necessity of selling cheap corn, and the loss of the profitable use of other resources; and, lastly, that increasing rent \$1 per acre on farms averaging 205 acres decreased labor earnings \$175 per farm, indicating that only a small part of the higher rents were in consequence of more productive farms but were, on the other hand, due chiefly to less advantageous bargaining.

**Agriculture in Crawford, Dubois, Perry, Pike, Spencer, and Warrick Counties,** W. Q. FITCH (*Purdue Agr. Ext. Bul.* 116 (1923), pp. 40, figs. 35).—This is a report of a survey of six counties in southern Indiana which preceded the formulation of an agricultural program. It covers soils and crops, dairying, poultry, roads, and marketing.

**Dairy farm management in New Hampshire,** H. C. WOODWORTH (*N. H. Agr. Col. Ext. Bul.* 20 (1923), pp. 31, figs. 14).—The dairy industry in New Hampshire and its markets are briefly described. Estimates are made of the cost of producing milk, and suggestions are offered with reference to the organization of a dairy farm and the maintenance of soil fertility.

**Organization of the agricultural industry in Queensland, I-IV,** J. D. STORY and J. F. F. REID (*Queensland Agr. Jour.*, 19 (1923), Nos. 3, pp. 166-171, fig. 1; 4, pp. 258-267; 5, pp. 358-365; 6, pp. 458-468).—In the first article of this series the American Farm Bureau Federation is described and compared with the plan of the Queensland Producers' Association. In the second installment various phases of American marketing methods relating particularly to fruit are discussed. The third article deals with primary producers' marketing prob-



lems and cooperation in general. The concluding article covers agricultural organization, education, and extension, and discusses the applicability of tested modern methods to conditions in Queensland.

**Our land system and the national food supply**, R. P. WRIGHT (*Jour. Univ. Col. Wales, Agr. Dept.*, 12 (1923), pp. 5-14).—The attempt is made to refute the argument that German agriculture is more productive than that of Great Britain. It is demonstrated that the German farmer uses his land for the production of crops giving the maximum quantities of human food or converts his products economically into human food. One of the chief hindrances to a maximum food production in England and Scotland is said to be the fact that the game laws protect the animals which are crop pests. The agriculture of Germany is carried on mainly on small holdings while the land of Great Britain is devoted to large farms and more extensive cultivation.

**Farming partnerships in Spain** (*Bol. Agr. Téc. y Econ. [Spain]*, 15 (1923), No. 173, pp. 485-500).—This is a discussion of the forms of partnership contracts and share leasing prevailing in the principal provinces in agricultural districts of Spain. A bibliography of 11 titles is appended.

**The Agricultural Credits Act of 1923**, V. N. VALGREN (*Amer. Econ. Rev.*, 13 (1923), No. 3, pp. 442-460).—The events leading up to the enactment of the Agricultural Credits Act of 1923 are briefly related, and the act itself is outlined.

Commenting upon the various criticisms which have been offered, the author holds that whether or not the capital provided under the new act is to be adequate will be proved only as a result of actual experience. It is pointed out that while the farmer does need credit for a term longer than the three or six months' limit hitherto granted by the ordinary commercial bank, this is by no means true of all the credit used by him. The charge of paternalism is met with the suggestion that the need for better rural credit facilities had become fully recognized, and only by direct governmental action could results be quickly accomplished. The provision for exempting the new intermediate credit banks and their debentures from income or other taxes except taxes on real estate is regarded as the ground for one of the strongest objections.

The question of coupling the new banks with the existing Federal land banks is said to have caused a considerable controversy. With these banks closely associated with the existing land banks and managed by the same officers and directors, a nucleus exists which may be quickly expanded as demand for intermediate credit dictates. The assets and liabilities of the Federal and the intermediate credit banks are entirely separate and distinct, and the author holds that the existence of the new banks can scarcely affect the marketability of bonds issued by the Federal land bank as such.

The increase in the limit of mortgage loans to individual farmers from \$10,000 to \$25,000 as provided in an amendment to the Federal Farm Loan Act is deemed particularly important to the States of the Middle West where farms are relatively large in spite of high land values. The importance of the Federal intermediate credit banks to farmers' cooperative associations, particularly after the War Finance Corporation will have withdrawn its support, can scarcely be doubted. The effect of the new legislation upon the cost of credit may be expected to be important in such districts as comprise parts of larger deficiency areas from the point of view of loanable funds.

**Farm credit in North Carolina.**—A survey of 800 farms, F. R. YODER, H. S. BEARDSLEY, and A. J. HONEYCUTT (*N. C. Dept. Agr. Bul.*, 1923, May, pp. 28, fig. 1).—A survey of 800 farms in three sections of North Carolina established the fact regarding credit conditions in 1921 that more than half of all credit obtained for current expenses was advanced by stores and less than one-sixth



by banks. Advances from landlords to tenants were almost equal to all short-term bank advances to farmers. More than one-half of all credit obtained for long-term purposes on land mortgage security came from individuals, commercial banks furnishing not quite one-fifth. The average rate of interest charged for short-term advances from banks was 6.3 per cent, as compared with 26.6 per cent from stores. Collateral was required for less than 5 per cent of the short-term advances made by banks, whereas more than 40 per cent of the advances from stores were fully secured. Credit unions or cooperative societies especially chartered under State law by the North Carolina State division of markets are advocated as a means of improving the credit facilities for farmers. Increasing the supply of garden truck and feeds grown on the farm and the better use of legumes and livestock are recommended as reducing the need for large credit extensions.

**Farm labor supply and business**, G. C. HAAS (*Jour. Farm Econ.*, 5 (1923), No. 3, pp. 163-165, figs. 2).—The purpose of this discussion is to throw some light on the reliability or accuracy of the estimates secured by the U. S. D. A. Bureau of Agricultural Economics with reference to the supply and demand of farm labor on April 1 of each year and to show the relationship between farm labor conditions and the business cycle. A remarkable correspondence between the farm labor and the business cycle indexes confirms a theoretical analysis of the relationship between the two.

**Agricultural wage earners in France**, V. B. TURNER (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev.*, 17 (1923), No. 1, pp. 34-46).—This review describes the land divisions in France, tabulates the number of agricultural workers as given by the census of 1911, discusses the causes and some suggested remedies for the exodus from the land, and describes foreign labor in French agriculture, trade unionism, wages, cost of living, and hours through a period of years up to and including 1922.

**Agricultural wages and hours of labor in Scandinavian countries in 1921 and 1922** (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev.*, 16 (1923), No. 6, pp. 129-131).—Account is taken in the tables and notes presented here of the season of the year and the sex and occupation of the worker. The item of board and lodging is shown where available, and comparisons between the rates for 1921 or 1922 and those of 1913 or 1915-16 are established.

**Possibilities of improving marketing through better organization**, H. B. PRICE (*Jour. Farm Econ.*, 5 (1923), No. 3, pp. 129-146, figs. 2).—The problem of marketing organization is approached from the point of view of interunit organization, which has to do with the number and type of the marketing units between the producer and the consumer, the division of marketing functions between these different types of agencies and their relation to each other, and intraunit organization having to do with the internal organization of each of the several types of marketing unit. Three aspects of the latter phase of the problem are distinguished as economic, business, and financial organization, and this discussion is limited to the first two.

A wide variation is noted in costs per unit of output, labor and management costs being the most elastic. A comparison of commissions charged by federated and integrated farmers' cooperative marketing associations seems to indicate that there are some small economies in large scale cooperative marketing, but the important service which these associations may render is held to be rather the better adjustment of supply and demand or both to the market. Reference is briefly made to the scarcity of high-grade management as a limiting factor on more efficient intraunit and interunit marketing.

The discussion of this paper, which was read before the meeting of the American Farm Economic Association, December 28, 1922, was contributed by R. M. Green.



**A grower's marketing machine**, R. E. HANLEY (*Jour. Farm Econ.*, 5 (1923), No. 3, pp. 147-152).—This paper, read before the meeting noted above, gives a brief description of the Federated Fruit and Vegetable Growers, Inc., a cooperative growers' national marketing organization which not only furnishes a sales corps distributed among the markets, but supplies to those associations requiring them sales managers at shipping headquarters who conduct the sales operations under the counsel of the growers. At the close of the shipping period in one district, these sales managers and their assistants are transferred to other active shipping districts.

**Marketing northwestern apples**, H. H. MAYNARD (*New York: Ronald Press Co.*, 1923, pp. VII+190, pl. 1, figs. 2).—This book outlines the methods of marketing boxed apples and includes discussions of problems of intensive production, grading and standardization, rail transportation, sales in distant markets, and large scale assembly and cold storage.

**Cooperative marketing of livestock in Ohio, 1921-22.**—A preliminary study, B. A. WALLACE (*Ohio Agr. Col. Ext. Circ.*, 8 (1922-23), No. 8, pp. 28, figs. 18).—Suggestive charts are presented depicting the fluctuations in the business of cooperative livestock associations in Ohio in 1921, 1922, and 1923.

**Organizing farmers for economic and political action**, C. C. TAYLOR (*Amer. Sociol. Soc. Pubs.*, 17 (1923), pp. 194-199).—In this paper, presented at a conference on rural sociology held by the American Sociological Society, December 27-29, 1922, farmers are said to be all now a part of an agrarian movement which has arisen out of the knowledge of the use of machinery with which to gain political and economic ends. It is called a parallel in social psychology to the labor movement and the industrial revolution. This movement will challenge some of the major practices in our economic world and some of the dominant traditions and habits in our social life.

**Agrarian reform in Esthonia: A means of suppressing the racial minority**, G. BOGDANOFF (*Berlin: Baltischer Verlag u. Ostbuchhandl. G. m. b. H.*, 1922, pp. 16).—This is a criticism of legislation enacted since 1919 from the point of view of the dispossessed owners of baronial estates, who were largely Balto-Saxons.

**International yearbook of agricultural legislation** (*Inst. Internatl. Agr. [Rome], Ann. Internatl. Lég. Agr.*, 12 (1922), pp. LIII+1056).—This volume presents the text of current legislation for 1922 continuing the series previously noted (*E. S. R.*, 48, p. 792).

**What farm women are thinking**, G. A. LUNDQUIST (*Minn. Agr. Ext. Spec. Bul.* 71 (1923), pp. 24, figs. 7).—The replies of 892 farm women of Minnesota to a questionnaire calling forth their views upon the production unit on the farm and the human and social unit are presented here. The average size of farms reported approximates very closely that of the average farm in the State. Of the answers received, 800 were in the affirmative as to the favorable human and social aspects of country life.

**The statutes in use by Swiss agricultural associations**, KÖNIG and RUBATTEL (*Sec. Paysans Suisses Pubs. No. 62* (1922), pp. 365).—This volume reproduces a large number of statutes and regulations which have been adopted by agricultural organizations of various types.

**International yearbook of agricultural statistics, 1922** (*Internatl. Inst. Agr. [Rome], Internatl. Yearbook Agr. Statis.*, 1922, pp. XLVII+364).—This report supplements the data for the previous years noted (*E. S. R.*, 48, p. 494).

**Statistical annual of the Republic of Chile.**—VII, Agriculture, 1920-21, (*An. Estadis. Chile. 1920-21, Sect. VII*, pp. [4]+140).—Statistics of agriculture for the year 1920-21 are tabulated in these pages, continuing the series of reports previously noted (*E. S. R.*, 49, p. 895).



[Agricultural statistics of France, 1921 and 1922] (*Ann. Statist. [France]*, 37 (1921), pp. 127-173; 38 (1922), pp. 50-54, 219-256).—These annual reports continue the series previously noted (*E. S. R.*, 46, p. 392).

### AGRICULTURAL EDUCATION.

**The professional training of rural leaders**, E. L. MORGAN (*Amer. Sociol. Soc. Pubs.*, 17 (1923), pp. 185-190).—This paper was presented at a conference on rural sociology held by the American Sociological Society, December 27-29, 1922.

Leadership is recognized as one of the prime needs of the small town and open country, and those who are to serve as leaders must be specifically trained for the task. The courses of instruction and supervised field work offered at the University of Missouri in rural social service are described in detail.

**Rural sociology as a college discipline**, P. L. VOGT (*Amer. Sociol. Soc. Pubs.*, 17 (1923), pp. 190-194).—In this paper, presented at the conference noted above, it is stated that rural sociology provides a knowledge of social environment required for adequate life adjustments, fosters mental development, and utilizes the laboratory method of study of the students' own experiences and observations. Rural life offers an ample field for study. The teacher of rural social science has the opportunity for engaging in pioneer research and for developing in his students scientific attitudes and methods.

**Agricultural instruction [in Ireland]**, P. HOGAN (*Ireland Dept. Agr. and Tech. Instr., Ann. Gen. Rpt.*, 21 (1920-21), pp. 16-33).—Reports for 1920-21 are made with reference to the agricultural colleges and schools in Ireland, and notes are presented on itinerant instruction, demonstrations, short courses, and competitions, as noted for earlier years (*E. S. R.*, 47, p. 597).

**Data regarding high school students of agriculture in Oregon**, E. E. ELIOTT (*Vocat. Ed. Mag.*, 2 (1923), No. 2, pp. 103-106).—This is a summary of replies to a questionnaire sent out to each of the agricultural instructors employed in Oregon and collected by them from students in their classes. The effort was made to secure information as to the reason why the student selected the subject, his plans for attending college or some other institution, his preference among all the studies in which he had enrolled, a statement of the agricultural study pursued each year and the grade earned, and the average grades for all other high school subjects for the years preceding enrollment in agriculture.

It is revealed that a very large number of these agricultural students have the fixed intention of returning to the farm or of linking up their future careers with agriculture, and the majority of those planning for advanced education are thinking of the agricultural college.

**Deriving courses of study in vocational agriculture from occupational analyses of farming employments**, C. E. GENTRY (*Vocat. Ed. Mag.*, 2 (1923), No. 4, pp. 271-278).—Three types of occupational analyses are differentiated as preliminary surveys, outline job analyses, and supervised farm studies. Teachers are urged to define for themselves definite objective standards of attainment in teaching, to carefully adapt the course content to the agriculture of the region and to the age and experience of their students, to determine the emphasis to be given to different enterprises, and to arrange courses taking into consideration the time available, the demand for flexibility and development, and the correlation of enterprises. An outline is presented of suggested procedure in so arranging a course of study.

**Analysis of the management of a farm business**, C. H. SCHOPMEYER (*Fed. Bd. Vocat. Ed. Bul.*, 88 (1923), pp. V+26).—The managerial-training content of the type jobs of a farm as a business unit has been analyzed. The 30 jobs



which have been separated into factors or elements and for which is listed the kind of information needed for applying those factors are as follows: Procuring a farm; determining what enterprises to conduct, the extent of each enterprise, and what farm and farmstead improvements to make; financing the farm business; determining what records to keep; taking the inventory; keeping the records; summarizing the records and accounts at the close of the accounting period; interpreting the records and accounts; buying building materials, tools and machinery, fencing material, fertilizer, and feeds; insuring farm buildings and equipment, stored grain, feed, and other commodities and supplies, livestock, and growing crops; hiring farm labor; handling farm employees; making returns for tax assessments; paying local, State, and income taxes; finding markets for farm commodities; establishing relations with neighbors; affiliating with agricultural organizations; and determining what support to give local or State proposals pertaining to public utilities or public services, and governmental proposals or movements affecting the welfare of the farmer. Publications of the U. S. Department of Agriculture relating to farm management are listed.

**Standards of accomplishment in home economics instruction**, I. P. O'LEARY (*Vocat. Ed. Mag.*, 2 (1923), No. 2, pp. 123-127).—This article discusses certain minimum standards of accomplishment in home economics instruction as they have been worked out in the vocational schools of New Jersey. It is recognized that the vocational school girl is a transient in education, and for this reason the instruction is arranged in units complete and well balanced in so far as possible in order to insure these pupils a working knowledge of the bare essentials of housekeeping. Block 1, which is presented here, outlines a minimum period of cooking instruction. Blocks 2, 3, and 4 include the more elaborate processes to be taught in longer periods.

**A plan for home economics education as a part of a four-year teacher training course**, R. MICHAELS (*Vocat. Ed. Mag.*, 2 (1923), No. 4, pp. 299-301).—Four unit courses concerned, respectively, with the development of home economics work, its organization and administration, methods of teaching courses in home economics, and directed teaching are outlined here. It is expected that these courses will be given in the junior and senior years when the quarter or term system is used. If the semester plan is followed it is deemed advisable to place unit 1 in the second semester of the sophomore year, units 2 and 3 in the junior, and unit 4 in the senior year.

**The home project as a regular part of a two-year vocational home economics program**, C. N. FLEMINGTON and M. HOPKINS (*Vocat. Ed. Mag.*, 2 (1923), No. 4, pp. 301-303, figs. 2).—Diagrams are drawn illustrating how home project work may be related to classroom instruction in home economics and related subjects.

**Child care and nursing in the home**, J. HAMILTON (*Vocat. Ed. Mag.*, 2 (1923), No. 4, pp. 303, 304).—Five projects are outlined here, texts are recommended, and a brief bibliography is given.

**Courses of study in agriculture** (*Harrisburg: Penn. Dept. Pub. Instr.*, 1923, pp. 137).—Syllabuses in prevocational agriculture for rural schools and for junior high schools, as well as for both general and vocational agriculture for high schools, are reproduced in these pages, with numerous bibliographies. Outlines of unit courses in farming subjects are also given.

**Productive vegetable growing**, J. W. LLOYD (*Philadelphia and London: J. B. Lippincott Co.*, 1923, 4. ed., rev., pp. XIII+343, pl. 1, figs. 194).—The manual and textbook previously noted (*E. S. R.*, 33, p. 398) has been slightly revised.

## NOTES.

---

**Alabama College and Station.**—Dr. W. E. Hinds, professor of zoology and entomology and station entomologist, has resigned to become entomologist in the Louisiana Stations, beginning April 1.

**Illinois University.**—The new agricultural building, built and equipped under an appropriation of \$500,000 granted by the legislature of 1921, was dedicated January 25 as a part of the closing program of farmers' week. The principal addresses were given by Dr. Eugene Davenport, dean and professor emeritus of the College of Agriculture, on the subject of Making Headway in Scientific Agriculture, and by Dean H. W. Mumford, who spoke on The Influence of Education and Research on Agricultural Progress.

The building is a 3-story and basement, brick structure, 300 ft. long and 95 ft. deep in the wings. It will be used primarily as a classroom and office building, containing over 50 office rooms and 25 classrooms, two of large size, and a spacious reading room and seminar for the agricultural library. It will constitute the center of a new group of university buildings. A similar building for the College of Agriculture will eventually adjoin it and constitute with it a unit structure. A building for the College of Commerce will face it, construction to be begun in the near future.

Urometre 145695, a 3-year-old colt purchased by J. L. Edmonds after an inspection of the French breeding establishments last summer, has been installed at the head of the university stud of Percherons.

**Iowa College.**—Horace J. Andrews, assistant professor of forestry, has resigned to take effect May 1, to become director of the Michigan land economic survey.

**Kansas College.**—A radio agricultural course, broadcasted during the week of February 11 and arranged by the extension service, is described in a recent issue of the *Kansas Industrialist*. The lectures, interspersed with music, lasted for one hour each evening and included for the five evenings poultry husbandry, dairying and livestock, crops, truck crops and soils, agricultural economics, and home economics. Written examinations were provided for enrolled students at the completion of the course, together with certificates of graduation.

**Louisiana Stations.**—The field work of the Sugar Station, located for many years at Audubon Park, New Orleans, has been transferred to the new college farm at Baton Rouge, where a tract of about 90 acres is available for plant experiments. About 1,600 sugar cane seedlings have been planted, and from 2,500 to 3,000 additional seedlings obtained from the U. S. Department of Agriculture will be set out this spring.

A contract for the erection of the new sugar house for the use of the station and the Audubon Sugar School was awarded February 15, authorizing an expenditure of \$57,000. The portion of the building in which the equipment, exclusive of the crusher and mills, will be placed, will be four stories in height and provided with a gravity system. The building will be only partially equipped with sugar machinery this year, from \$125,000 to \$150,000 being required for its full equipment for experimental and teaching purposes.

W. G. Taggart, assistant director in charge of the Sugar Station, continues in charge of the work in its new location.



**Minnesota University.**—The new dairy building has been completed with the exception of the third floor, which is to be left unfinished to permit of further expansion. The building provides eight classrooms with a total seating capacity of 240 students, as well as a large reading room and library, several laboratories for both instruction and experimental work, and a seminar room. The basement and wing contains the products division with a testing room, two laboratories for short-course work, animal experimenting rooms for the dairy chemistry and nutrition sections, and facilities for the manufacture of butter, cheese, ice cream, and the handling of market milk.

**New York State Station.**—The station has leased from Vassar College a building to be used for laboratory purposes in connection with the special insect and plant disease investigations under way in the Hudson River Valley.

The Cortland apple, one of the most promising of the new varieties originated by the station horticulturists, has been awarded the Wilder silver medal for new fruits by the American Pomological Society.

H. G. Beattie, assistant chemist, resigned February 1 to accept a commercial position.

**Oregon College and Station.**—Claude Isaac Lewis, head of the horticultural work of the college and station from 1906 to 1919 and one of the most widely known horticulturists of the country, died at Chicago, Ill., January 15, at the age of 43 years.

Professor Lewis was born in Cardiff, Wales, in 1880, coming to Massachusetts in infancy. He was graduated from the Massachusetts Agricultural College in 1902, and spent the three years following as professor of natural science and agriculture at Alfred University, organizing agricultural instruction at this institution and laying the foundations for its subsequent development into the New York State School of Agriculture at Alfred University.

In 1906 he obtained the M. S. degree from Cornell University, and soon afterward was appointed professor of horticulture in the Oregon College, horticulturist in the station, and State horticulturist. In the ensuing 13 years his ability as an organizer led to the development from very meager beginnings of one of the strongest horticultural divisions in the country. Such was the confidence he inspired among the fruit and nut growers of the Northwest that his efforts led not only to generous State appropriations for his own work but also played a large part in the expansion of the institution as a whole. One of the very first, and for a long time the largest, fruit by-product laboratories at any agricultural college was built and equipped as a result of his initiative.

Over 50 bulletins dealing with orchard economics, the handling of fruit, horticultural by-products, fertilization and pollination, pruning, etc., were prepared personally or under his supervision, as well as a long list of contributions to horticultural and other journals. He also became in great demand as a speaker on horticultural subjects, and conducted an exceptionally heavy correspondence throughout the coast region. His efforts to utilize the loganberry, his promotion of nut culture, his orchard management studies, and the fundamental investigations begun under his direction on the principles of pruning and plant nutrition may be cited as typical of the manifold projects undertaken. During the last of his stay at the college, he also served as vice director of the station.

Becoming especially interested in the commercial aspects of orcharding and in the possibilities of cooperation, he resigned in 1919 from the college and station staff to become organizing manager of the Oregon Growers' Cooperative Association, and in this capacity founded and edited the *Oregon Grower*. In 1922 he

was appointed managing editor of the *American Fruit Grower Magazine*, with headquarters at Chicago. In these various capacities he exercised much influence. He was a member of the National Agricultural Conference called by President Harding in 1922, and one of the small group of agricultural editors summoned in an advisory capacity by Secretary Wallace of the U. S. Department of Agriculture in 1923.

**Porto Rico Federal Station.**—Robert L. Davis has been appointed plant breeder vice Thomas Bregger, who has accepted a position with the Government of Argentina.

**South Carolina Station.**—Dr. N. E. Winters, head of the division of boll weevil control, has accepted an appointment with the division of cotton investigations of the Argentine Ministry of Agriculture.

**Virginia Station.**—The legislature has appropriated to the station \$62,900 for the fiscal year beginning March 1 and \$62,900 for the ensuing year. In addition to the above amounts, allotment has been made through the State Department of Agriculture of \$9,675 and \$9,655, respectively, for the two fiscal years for the support of substations in Augusta, Henry, and Charlotte Counties. The net increase in State support for the work of the station for the new biennium is slightly above 20 per cent in comparison with the preceding biennium.

**Wisconsin University and Station.**—The Wisconsin Experiment Association has presented a portrait of R. A. Moore, chairman of the department of agronomy, to the College of Agriculture in recognition of his services to the agriculture of the State in improving farm grains by selection, breeding, and in other ways. D. H. Reid, assistant professor of poultry husbandry and assistant poultry husbandman, has resigned to become head of the poultry department in the Texas College.

**Potato Association of America.**—The tenth annual meeting of this association was held at Cincinnati, December 27–29, 1923. In addition to the usual reports of committees, the program provided for symposia dealing with fertilizers, grading and marketing, and scab control.

The outstanding features in the relation of science to the potato industry during the past 75 years were shown in a paper by W. Stuart to be the development of a distinct race of American varieties of potatoes beginning with the Garnet Chili, Early Rose, Peerless, Prolific, etc.; the development of insect and fungus disease control methods; the origin and perfection of Bordeaux mixture; the development of automatic horse-drawn potato planters and diggers; production of high grade seed potatoes; disinfection of seed potatoes; the use of chemical fertilizers; the study of virus diseases and their relation to the so-called degeneration of potato varieties; group classification of varieties; varietal or group adaptation to environmental conditions; and standardization of varieties.

Officers for the ensuing year were elected as follows: President, A. G. Tolaas of Minnesota; vice president, S. G. Peppin of Prince Edward Island; and secretary-treasurer, W. Stuart of the U. S. Department of Agriculture.

**Association of Southern Agricultural Workers.**—The twenty-fifth annual convention of this association was held at Birmingham, Ala., January 10–12, with delegates from all the agricultural colleges and experiment stations of the South and a considerable number from the U. S. Department of Agriculture.

The president of the association, D. C. Hull of Mississippi, in the opening address declared that the future of the Southern States and of their people is irrevocably linked with agriculture. The South has other major resources, both actual and prospective, but there is a logical and necessary interdependence



between the development of these vast deposits and the development of the soils. The entire economic structure of this section must forever rest upon the agricultural program, and from this program and from the business and industry which it supports must come the revenues for the maintenance of the educational institutions and the religious movements. "In the face of this large dependence of business, education, and the institutions of the church upon the produce of our farms, the agricultural procedure of the entire South remains, with some hopeful but minor exception, tragically primitive." He discussed soil erosion, the one-crop system, farm tenancy, disparity between production costs and consumers' prices, and competition between agriculture and industry for labor, as factors hindering agricultural progress. The present tariff laws were pointed out as enhancing unduly the value of the industrial workers' labor and depreciating the worth of the farmers' toil. In discussing the demand for constructive information, Dr. Hull referred to the need of unanimity and agreement between legitimate counselors and advisors.

Attention was called to the industrial development of the South and the opinion expressed that there must be diversification in industry as well as in agriculture. "The era of industrial development, now surely setting in towards the South, will mean a vastly larger population and a vastly increased wealth. It will mean bigger business, larger taxable values, larger research programs, better supported colleges, a more intelligent people. It must be made to mean a new day for southern agriculture; and, in that new day, I confidently expect that the inexorable logic of events will bring to the agricultural college and to the competent agricultural worker that prestige in leadership which though long withheld can not be permanently denied."

Discussions of methods for the control of the boll weevil and their comparative success occupied a prominent place in the meetings. Results obtained in boll weevil control in 1923 by the calcium arsenate method were reported on by B. R. Coad of the Bureau of Entomology, U. S. D. A., the Florida method by W. Newell of Florida, and the molasses-calcium arsenate mixture by D. R. Coker of South Carolina. The program for boll weevil control in 1924, as recommended by the general committee on cotton production and boll weevil control and adopted by the association, called for greater acre production instead of increased acreage, gave directions for the province, time, and practice with each of the three weevil control methods; advised fall destruction of green cotton stalks; urged community action in weevil control; called for approved varieties and cultural methods; and recommended seed treatment, rotation, and resistant varieties to avoid diseases.

Resolutions were passed urging increased appropriations for experiment stations and boll weevil control investigations, and the protection and increase of insect and rodent eating birds by legislation, refuges, and other means.

The program provided for the usual sectional meetings, comprising the agronomy section; the animal husbandry section, dealing with teaching and control, livestock extension, and investigation programs; the dairy section; the entomology section; the horticultural section; the phytopathological section; and the resident teaching program.

The following officers were elected: President, J. N. Harper of Georgia; secretary-treasurer, H. W. Barre of South Carolina; and additional members of the executive committee, H. A. Morgan of Tennessee and D. C. Hull of Mississippi.

**Agricultural Education in Brazil.**—An address was recently given by Dr. P. H. Rolfs, president of the College of Agriculture and Veterinary Science of Minas Geraes, before a special meeting of the Brazilian National Society of



Agriculture at Rio de Janeiro. The subject of the address was The Agricultural College of Minas Geraes and the National System of Agricultural Colleges.

The main building of the college is now under roof. The director's residence has been occupied, and about 200 experimental plats varying in size from less than a meter square to one-tenth hectare have been laid out. The work is attracting very favorable attention. Weekly demonstrations in the use of agricultural implements, methods of seeding and planting, and methods of using fertilizers are being given.

The current budget of the Federal Ministry of Agriculture authorizes the establishment of an agricultural school in Macahyba, Rio Grande do Norte, and of another in the municipality of Barreiros, Pernambuco. The Government is further authorized to establish, in the Agricultural School of São Bento de Lage, Pernambuco, a school for teaching the higher branches of agriculture.

**Facilities Offered by Rothamsted to Research Workers.**—Arrangements have been completed whereby graduate students, including those from overseas countries, may pursue investigations at Rothamsted as a part of graduate work under either the University of Cambridge or the University of London. The degrees of M. Sc. and Ph. D. may be obtained from either institution or that of D. Sc. from the University of London. The requirements of the latter institution include a minimum of two years' residence at Rothamsted, while those of Cambridge prescribe a minimum of one term for the M. Sc. degree or three terms for that of Ph. D., with five and six terms, respectively, to be spent at the university. Further particulars may be obtained from Sir E. J. Russell, director of the Rothamsted Station.

**Sugar Research Institute in Czechoslovakia.**—The dedication of this institute took place at Prague, September 22, 1923. Dr. V. Staněk has been appointed in charge of the institute, which is being sponsored by the Central Association of the Czechoslovakian Sugar Industry. Considerable historical interest is attached to the opening of the new institution, as it is claimed that the first experiment station in the world to be devoted exclusively to sugar research was established in Prague about 1850, later being removed to Vienna.

**Miscellaneous.**—The late William Prescott has bequeathed £20,000 to the University of Liverpool to found a chair of agriculture or a chair for the furtherance of one or more of the following subjects: The chemistry of agriculture; the cultivation of land; the care, breeding, and raising of crops; the diseases of crops; or any other subject connected with agriculture. The university is given a period of 12 months for the acceptance or refusal of this bequest.

The American Legation at Belgrade reports that the Serbian Agricultural Service has decided to send each year 20 young people of farm origin to Czechoslovakia for their enlightenment along agricultural lines. Their sojourn would continue from March to November.

Robert L. Pendleton, Ph. D. (University of California, 1917), director of agriculture in Gwalior State, India, has been appointed professor of soil technology and in charge of the work in soils in the department of agronomy, College of Agriculture, University of the Philippines.

The University of Saskatchewan is building a laboratory for animal research. Seymour Hadwen, D. V. S., has been appointed research professor of animal diseases and A. J. G. Mow instructor in poultry husbandry.

The Fourth International Soil Conference will be held in Rome during the latter half of May.



# EXPERIMENT STATION RECORD.

VOL. 50.

APRIL, 1924.

---

No. 5.

It is sometimes suggested that the work of the experiment stations has reached the stage of diminishing returns. This is not said in a critical or doubting way but rather by comparison with the earlier years, when the opportunity for quick returns was open in many lines. It is a recognition of the fact that, in general, a more difficult stage has been reached in agricultural investigation which requires more time to accomplish desired ends, and hence may lead to a decrease in volume of quickly applicable results of striking importance.

In a sense the suggestion is a rational one and not without foundation. The extent to which it is true depends upon the measure employed in evaluating the product. The output of the stations in the first 25 years of their existence was so large and varied as to make a tremendous impress. It first won the confidence of the public, and this made possible far-reaching reforms in nearly every branch of the industry. In this way many of the questions requiring less intensive study and for which existing facts of science could be drawn upon have been given attention. But while this has been going on an increasing amount of fundamental research has been put under way and the technique and devices for it worked out; and beyond this, workers have been trained in quite large numbers who have the outlook and the understanding of original inquiry. This may serve to offset the tendency which would otherwise make itself felt.

In how far the product of experiment and investigation may diminish in relation to workers, funds, and facilities will depend to considerable extent on the attitude of those engaged in this field, and the use they make of their opportunities. In the possibilities for profitable work there is manifestly no decline, and the larger dependence which now rests upon research makes the field an increasingly stimulating one. There will be need for experimentation for many years to come—always, as far as can now be seen. The field appears larger than ever before. But the character of the problems and the kind of information needed have notably changed. Certain types of work and certain kinds of information have become inadequate. Results of limited applicability and information which sup-

plies rules but not reason only partially satisfy the demand in the present stage of enlightenment. Facts which can not be intelligently interpreted in relation to local conditions do not meet the need of the extension forces.

A conspicuous product of agricultural investigation has been an increasing appreciation of the type of work which gives understanding as well as bare facts, an expression of the desire for greater intelligence and more intimate knowledge. The value of such effort has been borne in on the public and its advisers as research has advanced. It recognizes the force of Bacon's contention that "experiments of light are even more to be sought after than experiments of fruit," and accords with Vergil's view that "fortunate indeed is he who perceives the causes of things." Our own Armsby spoke a great truth when he said that "one principle well founded is worth a thousand facts, because it includes them all." Not every worker can be so fortunate as to develop a new principle, but he may be able to uncover facts which lead to a new point of view or help to clarify what has been wholly empirical.

There is admittedly quite wide variation in the returns from money and effort invested in research. This has always been so, and it is probably no wider now than in the earlier stages. It lies in the nature of research, the outcome and the time limit of which can not be predicted. But omitting what was in reality extension work, it will hardly be questioned that the experiment stations are giving a greater actual return to farming and the public than at any earlier period. They are enabled to do this because their work has steadily advanced, embodied the new insight which has been gained, changed its point of view, and improved its technique. The results are more definite and accurate, more safe of interpretation, and the really new information is often supplied by a more direct and even more rapid process.

If the law of diminishing returns has already begun to operate with respect to certain types of experiments, it is because of inherent difficulties with the methods. In certain lines investigation by conventional methods appears to have proceeded about as far as it can be expected to yield results commensurate with the outgo of time, money, and human energy. The limitations of such common procedure have become quite obvious, and have made it clear that without new avenues of attack some of the large fundamental problems of agriculture will not be solved. The profitable stage of the gross attack, with the extensive collection of complex data in the hope that ultimately it would enable deductions or lead to generalizations has largely passed, except as a preliminary step. The tendency is toward simplification of the problem and of the conditions



of experiment, the breaking up of complex problems into their integral parts, the narrowing of the objective and the intensification of the method. It is marked also by the study of relationships, so that the effect of conditions may be better understood. Where this course is not followed results are less important than at an earlier stage, and the procedure fails to adequately represent advance in method and interpretation.

There is no science without progress. Isolated facts, however numerous, do not constitute science. "Science does not consist in the accumulation and cataloguing of such information, but in the establishment of relations between observed facts." Facts of observation were recorded long before they were understood. The determination of their meaning is a later step. Since science and discovery move forward by an evolutionary process, the means of adducing facts must likewise be a process of development. This comes as a result of progress in science and change in the point of view respecting the matter under investigation. Hence study of the method in order to improve the plan of attack is hardly less essential than study of the results secured by it. Without such study of both method and results, the making of experiments is relatively simple and may be a matter of routine.

A good observer is not necessarily a skillful investigator. His work may be that of a collector instead of a student of reactions and relationships and factors influencing them. Or his deductions may stop with comparisons, may not express the attitude of mind which travels from facts to conclusions. And so inadequacy in the plan of attack may escape him, or at least not result in correction which makes it more efficient and more original. Naturally such change ought not to be so abrupt as to sacrifice or endanger work long under way, but it ought not to be too long delayed. The real situation ought to be faced alike by investigators and those in authority. Otherwise the mistake will be made of clinging to means which in themselves have proved inadequate to carry through to final results.

There seems sometimes to be an exalted idea of the value of continuity—the continued pursuit of a subject by a fixed set of experiments studiously adhered to from year to year. Important as continuity is in following through an investigation, it may be as subject to criticism as fragmentary and vacillating effort unless the means and ends of research are being advanced. If it becomes stereotyped it is likely to degenerate into a round of routine, and it will not reflect progress in visualizing and pursuing the problem. There ought of course to be real intelligence behind every series of experiments, not alone at the outset but throughout succeeding stages. A protracted series especially ought to be inspired by

purpose and reason, and guided by critical judgment as to where and when it is necessary to supplement the usual line of observations. Neglect to digest the data and give them to the public in other than comparative form may be construed as mute evidence of the ineffective character of the work.

The conventional type of experiments still constitutes a considerable part of the station program. It is among these that the question of commensurate return in future finds most foundation. The weakness of some of them if subjected to discriminating analysis would be disclosed, and their justification might be questioned. The attempt to set forth succinctly the real problem they were aimed at and weigh the competence of the procedure to give final results capable of interpretation would show their complicated nature and the reason for their failure to advance.

One extensive series of experiments in operation more than 20 years was found to embrace some 20 separate questions, not intimately related to each other or to a general problem; and yet reliance throughout was placed on routine determinations by conventional methods and without attempt to exercise definite control over the larger factors of variation. It may have been of such a series that a recent writer remarked upon the "many figures" obtained and commented that "it is difficult to understand how accurate results could be expected when, to an already little understood complex substance, such as soil, is added a series of substances whose effects are practically unknown."

Research implies not only a problem but a type of mind with an impulse to wonder, to inquire, and to understand. It also implies time to think and study, as well as to carry out experiments and record data. Learning to think is one of the most important fundamentals in the making of an investigator. The exercise of the faculty of thinking is indispensable to good investigation of any type, although sometimes too little provision is made for it. Dr. F. M. McMurry, speaking at the recent Chicago Convention, remarked that eating and digesting are two different processes; thinking is the sum of the activities that provide for the digestion of facts. Accordingly he emphasized as essential to success "the ability to think, openness of mind so that one is receptive of new influences, and energy to think and execute." These are as essential in experimenting as in teaching, the subject under discussion; and so also is his further declaration that "to meet the demands of life, no matter in what field one is at work, success is not something resulting solely from past knowledge and activity; it is due to new effort, to a new adjustment. We can not live on our past alone." Thinking in experimenting must therefore be current, and it must guide future steps.



Closely related to the element of returns is the effect of too many projects, itself quite a common cause of decreased output. This may sound paradoxical, but the attempt of an individual or a station to carry more lines of experiment and investigation than can be properly cared for may easily defeat the real purposes, for reasons mentioned above. It may lead to widely scattered effort, too superficial attempts to get at the facts, too limited thinking about the method and results and, added to this, too meager support for any of the undertakings. It may and often does hold back results, because there is not time to compile and digest them and make them ready for publication. Sometimes it is responsible for unwarranted repetition because the investigator falls behind in his subject or continues a course of experiments after it has ceased to be productive.

What a station may do is rather definitely limited by its staff and its funds. In their zeal, workers may be over ambitious; they may overestimate their capacity for doing many things well, and underestimate the amount properly involved in the various projects to make the work adequate and complete. If the funds are not sufficient to go around, something must be omitted, and too frequently that something is an important essential.

Obviously financial support will play a large part in determining the volume of returns. This is due to the fact that more elaborate and expensive facilities are needed than formerly sufficed, and to the fact that a dollar does not go as far as it did a decade ago. An increase in research funds will help a station to spread its work over a wider field and in this way to perform a larger service, but it will not strengthen its research effort unless it strengthens the research staff. If a station continues to be restricted by a fixed scale of salaries applying throughout the college, it can not hope to stimulate the younger workers to better prepare themselves, hold those of demonstrated ability, and attract to itself investigators of the highest type.

Unless the station organization is free to reward the exceptional researcher, in position and in remuneration, increased funds will not necessarily lead to increasing the amount or raising the grade of investigation, and they may not be used to the highest advantage. The need is not primarily for more money to do more work of the same grade as in the past; it is to strengthen the search for new information, in degree as well as in scope. The range of activities needs to be extended to include branches and subjects which the stations can not now enter upon, and in these lines the best available material is the cheapest in the end.

There are many indications of the realization of these essentials. Indeed one of the notable signs in agricultural research is the narrowing of problems as they are attacked, without however losing

sight of the whole problem as presented in practice. This is a natural outcome of studies made for many years on the broader aspects of such questions. Such study has disclosed the real nature of such complex subjects and enabled analysis of them so that research may be more definitely directed. This limitation of the scope of inquiry brings it within a range where it can be made more searching and with larger chance of taking at least a small step in advance.

This is a very important development and has a definite relation to the future returns. The process is wholly in accordance with that in various departments of science. It means close study of the means adopted and of the results as they are developed. It is the opposite of gathering results over a broad field for study after a large volume has been accumulated.

In the more advanced types of seasoned inquiry it may safely be said that the stage of diminishing returns has not been reached, considered either from the standpoint of importance or the opportunity open to it. The returns may seem slower because of the study involved. But they have a larger element of originality, are less a confirmation or adaptation of other work, and give a different kind of information. They are more informing and more conclusive. They teach more things that are so, and less that involve a high degree of speculation.

This may be expected to continue in future. True, epoch-making discoveries are in large measure due to the relatively few, but the aim is to increase both the number and the proportion who participate in them, and this is the basis of the appeal for thorough training. If an investigator may not himself become a leader, he ought to be so prepared and so circumstanced that he can follow leadership and take advantage of the new advances and methods supplied by the leaders in science. This ability will mean more than the adoption of new suggestions or technique merely for the results secured with them, instead of as a tool or a new approach in studying an actual problem. The former sometimes occurs, as for example in the study of hydrogen ion concentration or of colloid properties purely from an abstract point of view. A new idea or a new tool is quickly taken up by a multitude of workers, but not always with a view to employing it in going to the heart of a concrete problem. The labors, therefore, are concerned with details relating to the process, and hence are incidental. While not to be minimized, they are routine as compared with the constructive product of original inquiry.

But the volume of experimentation and research of the best and most thorough type has assumed larger proportions than at any other stage, and it is unexcelled by any similar group of institutions. It has noticeably increased since the war, even though funds have grown but slightly. The reason for the larger volume can only be found in



the more broadly and severely trained forces, with forward look and ability to adjust themselves to changing conditions.

Furthermore, the results of station work are being placed before the public, on the whole, more promptly than ever. The output can not be measured alone by the bulletins and reports, as it formerly could. A large volume of the results are now published in scientific journals where they reach and help other specialists in advancing their studies—a return of no secondary importance to the effort as a whole. For the more practical results the bulletins and annual reports are supplemented by press notices, now greatly increased in amount, and by direct communication through the extension forces.

The stations as a body give no evidence of a decline in their output, nor may it be expected if there is care to keep the work progressive in spirit and method. They can not afford in future to see their usefulness as a research agency impaired, or the extent of their returns as measured by their importance, diminished. They are alive to this, and to the fact that avoidance of such a calamity rests primarily on the working staff. It is first of all an individual matter; after that it is an institutional problem.

The individual may well ask himself whether his research is growing in effectiveness, whether it is giving the returns it once did, and whether it is merely increasing in volume or advancing in kind. The prospect for the future of projects under way, and what may reasonably be expected of the ultimate harvest in view of the advances made in analogous projects, are matters for unprejudiced study. There is less justification than formerly for failure to recognize the stage of diminishing or vanishing returns. Such an oversight is out of harmony with the scientific method.

For the institution, the station, the question of effectiveness and steady growth of individual projects is one of successful administration. This is to be applied critically but not impatiently or unsympathetically to the individual members of the staff and their lines of work. Perhaps some assistance may be needed to enable a worker to see his own work in its true proportion or, again, he may be guided into a line where he fits better and gives a more commensurate return for the effort he puts forth. These are matters for the administrative officer. The study of his staff is something that can not be neglected. He needs to know and understand them, to realize where stimulation will be helpful and where restraint or criticism is warranted. In the last analysis the station and the public alike will depend upon him to make the most of the resources and facilities, and to guard against effort which has become ineffective or unprofitable. Then there will be no real diminution in returns.

## RECENT WORK IN AGRICULTURAL SCIENCE.

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

**Studies with phytosterols.**—Phytosterols of corn oil, cottonseed oil, and linseed oil, R. J. ANDERSON and M. G. MOORE (*New York State Sta. Tech. Bul.* 95 (1923), pp. 3-16; also in *Jour. Amer. Chem. Soc.*, 45 (1923), No. 8, pp. 1944-1953).—Following the study of the phytosterols in the fat of corn pollen previously noted (E. S. R., 49, p. 309), a similar study has been made of the unsaponifiable constituents of corn oil, cottonseed oil, and linseed oil.

None of these yielded phytosterols similar to those found in corn pollen. Corn oil yielded unsaponifiable matter to the extent of 2.01 per cent of the crude or 1.68 per cent of the refined edible oil. This consisted largely of a phytosterol identical with sitosterol. Cottonseed oil contained at least two phytosterols differing in melting point and probably in optical rotation, but difficult to separate. Linseed oil also contained two fractions separable with difficulty by fractional crystallization. The melting points of the various phytosterols and corresponding acetates were as follows: For corn oil 137.5 and 127° C., respectively; for linseed oil, fraction one 138 and from 129 to 130°, and fraction two 134 and 124°; and for cottonseed oil, fraction one from 138 to 139° and 124°, and fraction two from 134 to 135° and 119°, respectively.

**Chemical examination of "chufa," the tubers of *Cyperus esculentus*,** F. B. POWER and V. K. CHESNUT (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 2, pp. 69-75).—The tubers of *C. esculentus*, variously known as chufa, earth almond, and rush nut, have been subjected to chemical analysis at the Bureau of Chemistry, U. S. D. A.

The most important constituent is thought to be the fatty oil, a yield of 28.9 per cent of which was obtained on extraction with light petroleum. An analysis of this oil is reported in the paper noted below. Other constituents isolated were sucrose and starch, both of which are present in considerable amounts in the tuber. The sucrose is accompanied by a reducing sugar and a gummy material, which makes its complete separation difficult. The yield of starch, as separated directly from the tuber, was 12 per cent. A small amount of gum was separated by basic lead acetate. An enzyme capable of hydrolyzing amygdalin was found present. Negative tests were obtained for alkalis in general, caffeine, asparagin, cholin, and betain.

**The constituents of "chufa" oil, a fatty oil from the tubers of *Cyperus esculentus*,** W. F. BAUGHMAN and G. S. JAMIESON (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 2, pp. 77-82).—A chemical examination is reported of the oil obtained in the above study. The chemical and physical constants are given as follows: Specific gravity 25°/25° 0.9120, refractive index at 20° C. 1.4680, iodine number (Hanus) 76.5, saponification value 191.5, unsaponifiable matter (per cent) 0.6, acid value 15.7, acetyl value 10.5, Reichert-Meissl number 0.2, Polenske number 0.3, saturated acids (per cent observed) 18.3 (iodine number 6.5), unsaturated acids (per cent observed) 74.6, saturated acids (per cent corrected) 17.1, unsaturated acids (per cent corrected) 75.8, and iodine number of unsaturated acids 96.9.



The distribution of glycerids of the various fatty acids in the crude oil was found to be as follows: Glycerid of myristic acid, trace; of palmitic acid, 11.8 per cent; of stearic acid, 5.2; of arachidic acid, 0.5; of lignoceric acid, 0.3; of oleic acid, 73.3; and of linolic acid, 5.9 per cent.

A phytosterol melting at from 134° to 135° C. was isolated by F. B. Power from the unsaponifiable material.

**A study of the darkening of apple tissue**, E. L. OVERHOLSER and W. V. CRUESS (*California Sta. Tech. Paper* 7 (1923), p. 40).—The extensive investigation reported in this publication was undertaken with a view to suggesting some other method than the use of sulphurous acid for preventing the darkening of fruit on drying. Various terms occurring in the report are defined as follows: "(1) The oxidizing system is considered to consist of a peroxidase and an organic peroxid and is designated by the term oxidase. (2) The peroxidase is considered to be that part of the oxidizing system which has the power to cause the rapid transfer of the oxygen derived from the organic peroxid—normally occurring in most fruits, or derived from hydrogen peroxid—to the compounds which undergo oxidation, and behaving as an accelerator of this oxidation process. (3) The organic peroxid is considered to be that portion of the oxidizing system which, in the presence of peroxidase, liberates oxygen in an active state. (4) The chromogen is considered to be a substance of tannoid nature found in apples, which upon being oxidized gives rise to a brown pigment."

In the preliminary study of the nature of the darkening process it was found that positive tests for peroxidase in the fresh juice and scarified tissue of yellow Newtown apples were given with benzidin, tincture of guaiac, guaiacol, and  $\alpha$ -naphthol. Benzidin in 1 per cent aqueous solution proved the most satisfactory indicator of the four. Positive tests for the presence of organic peroxids were obtained with chromic acid and with potassium iodid and starch, using acetic acid in place of the ferrous sulphate in the latter test. The first test proved satisfactory for the apple juice, and the second was preferable for apple tissue.

A systematic study was then made of the relationship between the various components of the oxidizing system. It was found possible to separate the organic peroxid and peroxidase from the chromogen of the apple juice by precipitation of the enzymes with 95 per cent alcohol, as shown by the fact that browning of the solution freed from alcohol did not occur until a solution of the enzyme precipitate containing the peroxidase and organic peroxid was added. Apple juice boiled to destroy the peroxidase and organic peroxid did not darken on the addition of various inorganic catalysts with hydrogen peroxid until the acidity was reduced almost to the neutral point.

Qualitative tests to determine the nature and distribution of the apple chromogen or tannin indicated that it belongs to the catechol group and is quite evenly distributed in the tissues.

For the practical purpose of the investigation, as previously stated, a systematic study was then made of the effect of various factors upon the chromogen, peroxidase and organic peroxid of apples.

The peroxid was found to be more susceptible to heat than was the peroxidase. The former was activated at from 73.5 to 78° C. and the latter between 90 and 100°.

The storage of apples in various gases and vapors gave satisfactory results only in the case of nitrogen. Apples stored for one month in nitrogen remained normal in appearance even after removal from the gas and gave positive reaction for peroxidase and organic peroxid. Apples which had been stored in



carbon dioxid, hydrogen, oxygen, or in the vapor of carbon disulphid, formaldehyde, carbon tetrachlorid, benzene, ether, gasoline, and ethyl alcohol browned very rapidly and gave negative reactions for organic peroxid.

Immersion of slices of apples in 5 per cent solutions of sodium chlorid, hydrochloric acid, sodium sulphite, or cane sugar for 3 days prevented darkening of the tissue after removal from these solutions, but after similar immersion in tap water and in 5 per cent solution of sodium nitrite, sodium nitrate, or sodium carbonate darkening occurred. When the slices were immersed for only 5 minutes in various solutions, 5 per cent hydrochloric acid and 5 per cent sodium sulphite prevented, but sodium chlorid, cane sugar, and sodium nitrate reduced but did not prevent, subsequent browning. It is thought that the solution of sodium chlorid checked browning by inhibiting but not destroying the activity of the peroxidase and the peroxid. As far as could be judged by laboratory tests, a satisfactory dried apple product could be obtained after immersion in from 3 to 5 per cent sodium chlorid solutions, although the color was not so light as that obtained with sulphured lots.

With apple juice, browning was almost entirely prevented by  $N/10$  solutions of ammonium chlorid and of chlorids of barium, calcium, lithium, magnesium, potassium, and sodium, while  $N/100$  solutions retarded but did not prevent browning of the juice. Sulphates in similar concentrations had no effect in checking the browning of apple juice, with the exception of potassium aluminum sulphate, which retarded the darkening process. Nitrates increased, acetates and tartrates had no appreciable effect upon, and oxalates checked the browning of the juice.

A list of 33 references to the literature is appended.

**Chemical studies of grape pigments.**—The anthocyanins in Norton and Concord grapes, R. J. ANDERSON (*New York State Sta. Tech. Bul.* 96 (1923), pp. 3-19; also in *Jour. Biol. Chem.*, 57 (1923), No. 3, pp. 795-813).—Using the methods described by Willstätter and Zollinger (*E. S. R.*, 34, p. 709), the author has isolated and analyzed the coloring matter of two varieties of grapes, the Norton (*Vitis aestivalis*, *V. labrusca*) and the Concord (*V. labrusca*).

The anthocyanins in both these varieties were found to be identical and to consist of a monoglucosid anthocyanin differing from oenin derived from *V. vinifera* only in the color reaction with ferric chlorid. In water solution the color with this reagent changes to purple, but fades quickly to a light brown, while in an alcohol solution an intense blue color results, changing in a few minutes to a purple, which very slowly changes to a wine red. The anthocyanin chlorid corresponds to the formula  $C_{23}H_{26}O_{12}Cl$  and yields on hydrolysis with boiling  $HCl$  1 molecule of glucose and 1 of anthocyanidin chlorid  $C_{17}H_{16}O_7Cl$ . This separates in prismatic crystals, which are easily soluble in various alcohols and in dilute hydrochloric acid. On treating an aqueous solution of anthocyanidin with ferric chlorid, a momentary purplish color is formed which fades immediately, leaving a nearly colorless solution. The same color change takes place in an alcohol solution except that the final solution is pale yellow.

The spectrum of anthocyanin chlorid was found to consist of one broad band, with indefinite margins extending from the yellow into the blue.

**A study of the formation of gum levan from sucrose**, W. L. OWEN (*Jour. Bact.*, 8 (1923), No. 5, pp. 421-445; also in *La. Planter*, 71 (1923), Nos. 17, pp. 331-333; 18, pp. 353, 354; 19, pp. 373, 374).—An investigation is reported of the conditions under which gum levan is formed from sucrose. The results of the investigation have shown that the gum is formed directly from the sucrose by derivatives of the potato group of bacteria. The presence of invertase decreases gum formation in the proportion in which it hydrolyzes the sucrose



and to a degree dependent upon the H-ion concentration of the solution. The optimum pH value for the development of gum levan is between 6.7 and 7. The ability that bacteria of this type have of forming gum levan is thought to be easily acquired and fairly easily lost, and to represent "a means by which an organism secreting no invertase may convert the unassimilable disaccharid sucrose into assimilable forms, and into products whose combined osmotic pressure value is lower than that of the original sucrose. In this manner the material for supplying the energy for the organism is provided, and the environment, if its osmotic value is too high, is rendered more favorable for the continued growth and development of the organism."

The conditions for acquiring this property are to be found in cane sugar factories. The gum-forming bacteria are brought into the mill on particles of soil adhering to the cane, but, owing to the resistance of the spores to heat and their ability to withstand the osmotic pressure of high density sugars and molasses, are able to survive the conditions of the factory. A considerable amount of the bacteria is returned to the soil in the filter press cake and also in manure from stock fed the final molasses from the factory.

**The influence of heat on certain chemical and physical properties of cows' milk,** R. A. DUTCHER (*Pennsylvania Sta. Bul.* 181 (1923), pp. 18, 19).—The properties of raw and pasteurized milk have been compared by J. R. Haag and S. R. Shimer by analyzing the protein-free serums from each kind of milk for calcium, phosphorus, and nitrogen. Freezing points, H-ion concentration determinations, and nutrition studies with rats have also been made, but no significant differences have been observed between raw and pasteurized milk. Chemical analyses of the calcium, phosphorus, and nitrogen content of the intermediate layer between the sediment and cream line of samples which had been centrifuged also failed to reveal any differences between raw milk and milk which had been heated from 85 to 212° F.

**Rotation of chemical elements in agriculture,** W. GILTNER and R. M. SNYDER (*Michigan Sta. Quart. Bul.*, 6 (1923), No. 2, pp. 72-74, fig. 1).—A brief discussion, with illustrative chart, of the cycle of carbon in nature.

**The titrimetric adjustment of the H-ion concentration of bacteriologic culture media,** I. C. HALL (*Jour. Bact.*, 8 (1923), No. 4, pp. 387-392).—The technique employed by the author for the titrimetric adjustment of the H-ion concentration of culture media is essentially as follows: Assuming a pH value of 7 as the optimum reaction, the medium is first tested for alkalinity or acidity by adding 0.3 cc. of a 0.04 per cent solution of bromothymol blue in 50 per cent alcohol to 10 cc. of the medium in a white evaporating dish or in a beaker against a white background. A yellow color indicates an acid, a blue color an alkaline, and a green color a neutral medium. If the medium is acid sufficient dilute sodium hydroxid is added to bring the color to the exact shade of a standard buffer solution adjusted to pH 7 and containing the same amount of indicator in a similar vessel. The adjustment of the entire lot of the medium is then made, followed by a check test, and by another test after sterilization.

It is emphasized that the standard buffer solution must be prepared with great care and checked by the electrometric method, but that subsequent lots may be made by the titrimetric method, using the residue of the lot to be replaced for the color standard. It has been found that the buffer solution can be diluted to a considerable extent with ordinary distilled water without any color change. Titration without boiling is advocated as a routine procedure. The concentration of the indicator can be varied from 0.1 to 1 cc. of a 0.04 per cent alcoholic solution in 10 cc. of the standard buffer without altering the reaction. Too great a dilution of the medium should be avoided.



**Notes on some analytical methods,** H. F. L. BISCHOFF and B. DE C. MAR-  
CHAND (*Jour. So. African Chem. Inst.*, 6 (1923), No. 2, pp. 53-60).—Comments on  
various analytical methods for soils and fertilizers are given as follows:

I. *The determination of available potash in soils.*—The method employed in  
this determination consists in shaking 200 gm. of air-dried soil for 24 hours in  
a rotary shaker with 2 liters of 1 per cent citric acid, evaporating 1,500 cc.  
of the filtered solution to dryness, and igniting the residue to destroy organic  
matter. The residue is then treated by the Neubauer method (*E. S. R.*, 17,  
p. 731). To determine whether any loss of potash occurs in the various pro-  
cesses subsequent to the first extraction, the determination was conducted on  
two types of soil, one containing but little calcium and the other rich in  
calcium carbonate. A known amount of potassium chlorid was added at  
each stage of the operation and the amount of potassium recovered compared  
with that known to be present. No loss of potassium was noted.

II. *The determination of citric soluble phosphoric oxid in basic slag.*—A  
study is reported of the effect of variations in several factors on the determina-  
tion of citric soluble phosphoric acid in basic slag by the method previously  
noted (*E. S. R.*, 41, p. 411). As tested on four different samples of slag,  
including a composite sample, it was found that the time of shaking and type  
of shaker have very little effect on the amount of phosphoric oxid going into  
solution. Increasing the amount of 2 per cent citric acid by 50 per cent raised  
the amount to a slight but not marked extent.

III. *The influence of fine grinding on the solubility of bone and of rock  
phosphate in citric acid.*—Determinations of citric-soluble phosphoric acid are  
reported for samples of bone meal of different degrees of fineness obtained by  
grinding to pass through 1 mm.,  $\frac{1}{2}$  mm., and 100-mesh sieves. A marked increase  
in the percentage of citric-soluble material was noted with increasing fineness  
of the sample. It is recommended that for this determination the samples  
should not be ground or sifted.

**The determination of potash in mixed fertilizers,** E. C. REES and G.  
INGHAM (*Jour. So. African Chem. Inst.*, 6 (1923), No. 2, pp. 49-52).—The sources  
of error in the Official (alternative) method of determining potash in mixed  
fertilizers are outlined and discussed. Attention is called to a method known  
as the method of Corenwinder and Contamine included in Scott's Standard  
Methods of Analysis under the heading of modified chloroplatinate method.  
In this, after heating to char the organic matter and expel the ammonium  
salts, the residue is boiled for a short time with a little concentrated hydro-  
chloric acid, diluted with water, boiled 15 minutes longer, and then made up  
to mark. An aliquot is treated with sufficient platonic chlorid to combine with  
all the bases present, evaporated to dryness, and treated with 80 per cent  
alcohol in the usual way. The residue is then treated with hot water to  
dissolve the potassium platonic chlorid, and the solution is heated to boiling  
and treated with sodium formate, which reduces the platinum salt to colloidal  
platinum. A small amount of hydrochloric acid is added and the solution  
boiled, after which the platinum is washed on the filter with hot water until  
free from chlorids and is finally ignited and weighed.

This method is said to have the advantage of being much shorter than the  
Official method and to be free from the objection to the latter on the ground  
of possible occlusion of the potash in the heavy precipitates obtained by the  
addition of barium hydroxid and ammonium carbonate.

**Some observations on the sulphate-molybdate method of determining  
phosphoric oxid,** V. A. BECKLEY and A. MARAIS (*Jour. So. African Chem. Inst.*,  
6 (1923), No. 2, pp. 35-39).—Attention is called to errors that may arise in the



determination of phosphoric acid by the sulphate-molybdate method of Marchand (E. S. R., 41, p. 411) through dissociation of the phosphomolybdate precipitate, with consequent increase in acidity during the washing of the precipitate with sodium nitrate. The theory of this dissociation is discussed, and practical directions are given for avoiding it. It is recommended that the precipitate be washed carefully by decantation three times with 3 per cent sodium nitrate solution, and that in the succeeding washings the wash bottle be used as little as possible in transferring the precipitate to the crucible. The washings should be made with 20 cc. quantities, and the suction so arranged that the 20 cc. run through in not more than one minute. The acidity of the filtrate should be carefully watched from the fifth washing, and care should be taken that the precipitate does not stand undrained. As soon as the filtrate gives a red color with phenolphthalein on the addition of 0.05 cc. N/10 sodium hydroxid, the washing should be stopped.

**Investigation of different methods of testing Babcock milk bottles,** C. O. WILLIAMS (*So. African Jour. Sci.*, 19 (1922), pp. 132-136).—A comparison is reported of three methods of calibrating Babcock test bottles, namely, the volumetric and gravimetric methods using distilled water and the gravimetric method using mercury. The volumetric method is considered to be the least open to error of the three and the most practical for constant use.

**The chemical analysis of cotton.**—I, **The absorption of methylene blue by cotton,** C. BIRTWELL, D. A. CLIBBENS, and B. P. RIDGE (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem.*, 2 (1923), No. 18, pp. 227-243, fig. 1).—A systematic study has been made of the absorption of methylene blue, as determined by colorimetric or titrimetric methods, by a large number of samples of bleached cotton from different sources in the form of loose fiber, yarn, or cloth.

One of the determining factors in the extent of absorption was found to be the origin of the cotton. Egyptian cotton, wherever grown, showed consistently higher absorption than American cotton. Another factor influencing the absorption was the alkalinity of the ash of the cotton, which depends upon the efficiency of the washing process. For this reason it is necessary to wash all samples carefully with acid before making the methylene blue test. With the same type of cotton the absorption of methylene blue is a measure of the efficiency of the bleaching process. If the scouring process does not remove all of the noncellulose impurities of the raw material, the resulting absorption is high. The addition of soap or olein in the process of bleaching also results in an increased absorption of methylene blue. Processes such as calendering and mercerizing have no effect upon the absorption.

With cotton material of known origin it is thought that the methylene blue absorption test furnishes a method of following quantitatively the purification of the cellulose during bleaching and of measuring the success of the bleaching process. If the bleaching process is known the test can be used to furnish information on the origin of the raw cotton, particularly in distinguishing between Egyptian and American cottons.

**Determination of reducing sugars,** W. D. HORNE (*Facts About Sugar*, 17 (1923), No. 18, pp. 412, 413).—This is a brief description of the method developed by Lane and Eynon for the volumetric determination of reducing sugars by means of Fehling's solution with the use of an internal indicator (E. S. R., 49, p. 310).

**Neutral clarification and how to secure it,** A. H. ALLEN (*La. Planter*, 71 (1923), No. 8, pp. 151, 152).—Corallin is recommended in place of litmus in determining the reaction of raw sugar juices for subsequent neutral defecation. The method is described, and data are given on the effect of neutral defecation on the lime content of the juice.



**Bacterial decomposition of olives during pickling**, W. V. CRUESS and E. H. GUTHIER (*California Sta. Bul.* 368 (1923), pp. 3-15, figs. 5).—Investigations conducted during the olive picking seasons of 1921-22 and 1922-23 on the causes of bacterial decomposition of ripe olives during pickling are reported, with recommendations for the prevention of such spoilage.

The bacterial decomposition was found to occur more frequently during the washing of the fruit following the final lye treatment than at any other stage of the pickling process. The spoilage is marked first by the development of a characteristic sour odor and flavor, followed by bleaching of the olives, the formation of gas in the olives and brine, the appearance of "floaters" on the surface of the water or brine due to the formation of gas pockets, and finally the putrefaction of the olives. It is stated that the financial loss in California from this cause was over \$75,000 in 1921.

The investigation of the various factors responsible for the spoilage showed that the condition is caused by several types of organisms which may or may not be gas formers, and that the source of the infection is originally bacteria present in the olives and subsequently contamination of the tanks. Different varieties showed varying susceptibility to infection in decreasing order of Sevillano, Ascolano, Manzanillo, and Mission.

The temperature of the wash water was found to be an important factor in the development of infection. Spoilage was comparatively rare when the temperature of the water in the pickling vats was lower than 60° F. and also under conditions of storage in brine for several weeks before pickling.

As a control measure it is recommended that the olives be stored in brine for at least 25 days before pickling. The brine should have a concentration of from 6 to 7 per cent of salt for the first week, with an increase to 10 per cent for the remainder of the period. In factories where the wash water is cold (40 to 50°) the fermentation may be arrested by lye treatment, but in factories using water above 60° the olives fermenting during pickling should be pasteurized at 190° for 15 minutes, cooled to room temperature, treated with dilute lye to the pit, exposed 24 hours to the air to darken, and washed free from lye as rapidly as possible.

In factories in which bacterial decomposition has become established, the vats should be sterilized with boiling water and the washing process should be hastened as much as possible. The fruit should be stored no longer than necessary in dilute brine after pickling and should be canned as soon as possible.

## METEOROLOGY.

**Collected scientific papers of John Aitken**, edited by C. G. KNOTT (*Cambridge: Univ. Press*, 1923, pp. XXI+591, pls. 5, figs. 62; rev. in *Nature* [London], 112 (1923), No. 2814, pp. 495, 496).—This is a collection of 38 papers selected as the more important of the hundred or more scientific contributions of Aitken, which covered a rather wide field of physical research. Fourteen of the papers deal with what is considered Aitken's most notable contribution to science, viz, his studies on the relation of dust to condensation of water vapor and other atmospheric phenomena. The collection also contains papers dealing with the formation of dew, the dynamics of cyclones and anticyclones, and various other subjects. It is of interest to note that Aitken's conclusions (1885) that dew results mainly, if not entirely, from the condensation of water vapor arising from the soil and that dewdrops on leaves of plants are the condensed exhalations of the plants, are in general accord with results and conclusions previously reported by Levi Stockbridge (1879).



**Weather proverbs and paradoxes**, W. J. HUMPHREYS (*Baltimore: Williams & Wilkins Co., 1923, pp. VIII+125, pls. 16, figs. 2*).—This differs from other collections of weather proverbs and sayings in that it attempts "to separate the true and helpful from the false and misleading," and to show that many of them are "based upon abundant and accurate observations" and are therefore reliable and useful.

**Climatic cycles**, H. I. JENSEN (*Queensland Agr. Jour., 20 (1923), No. 5, pp. 361, 362*).—In further brief discussion of the dependence of terrestrial weather upon sun spot periods (E. S. R., 50, p. 315), the author emphasizes the importance of further study of the factors which determine the solar cycles.

**Group distribution and periodicity of annual rainfall amounts**, R. E. HORTON (*U. S. Mo. Weather Rev., 51 (1923), No. 10, pp. 515-521, figs. 2*).—In this study of the annual rainfall at Padua, 1725-1900; Havana, 1859-1914; New Bedford, Mass., 1814-1913; Cincinnati, 1850-1914; Albany, 1826-1918; and San Diego, 1850-51 to 1917-18, the author develops and applies a formula which is designed to facilitate group distribution of rainfall records and to afford "a more direct and precise criterion of periodicity."

**New rainfall maps in Brazil**, M. JEFFERSON (*Geogr. Rev., 14 (1924), No. 1, pp. 127-135, figs. 4*).—This is a brief critique of the recent contributions of Morize, Carvalho, and Ferraz on the distribution of rainfall in Brazil.

**The cotton plant in relation to temperature and rainfall**, C. B. WILLIAMS (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 32 (1923), pp. [1]+5, pls. 2*).—Data from various sources regarding temperature and rainfall in different cotton growing regions, including among others those of Egypt, the Sudan, Mesopotamia, Madras, Nigeria, Turkestan, and Texas, are shown in diagrams which are briefly interpreted.

With regard to temperature, these countries are considered of three types, those in which (1) cotton is a summer crop, (2) a winter crop, and (3) a year-round crop. In the first group cotton is planted on a rising temperature, in the second on a falling temperature. The possible extremes of temperature are from  $-20^{\circ}$  C. ( $-4^{\circ}$  F.) in Texas, Turkestan, and Chosen to  $55.5^{\circ}$  C. ( $131.9^{\circ}$  F.) in the Sudan. The average temperature at planting varies from a little over  $10^{\circ}$  C. (50 F.) in Turkestan to over  $32^{\circ}$  C. ( $89.6^{\circ}$  F.) in the Sudan. The average extremes at this time are from about 3 to  $40^{\circ}$  C. ( $37.4$  to  $104^{\circ}$  F.). The average temperature of the period of growth is between 24 and  $28^{\circ}$  C. ( $75.2$  and  $82.4^{\circ}$  F.). There is wide variation in rainfall, which in some cases is the determining factor. As in case of temperature, however, there is a "gradual increase in the constancy of conditions as we reach the time of the first picking. . . . By the time the bolls begin to ripen there is, in none of the countries shown, more than 50 mm. (2 in.) of rain in a month, and frequently the fall for several months about this time is negligible," the deficiency being made up by irrigation.

**Monthly Weather Review** (*U. S. Mo. Weather Rev., 51 (1923), Nos. 9, pp. 437-495, pls. 11, figs. 22; 10, pp. 497-560, pls. 34, figs. 19*).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for September and October, 1923, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 9.—The Law of Pressure Ratios and Its Application to the Charting of Isobars in the Lower Levels of the Troposphere (illus.), by C. L. Meisinger; The Winds of Oklahoma and East Texas (illus.), by J. A. Riley; Upper Air Observations at Sea, by F. G. Williams; The Anticyclone of September 12-18, 1923 (illus.), by A. J. Henry; Frequencies of Monthly and Seasonal Rainfalls



of Various Depths at San Jose, Calif. (illus.), by E. S. Nichols; Typhoon at Guam, M. I., March 19-27, 1923 (illus.), by J. H. West and J. D. Swartwout; Weather and the Berkeley Fire, by G. W. Alexander; Record-breaking Rainfall in Southern Michigan (illus.), by R. M. Dole; and Tornado at Council Bluffs, Iowa, September 28, 1923, by M. V. Robins.

No. 10.—Hernandez on the Temperature of Mexico (illus.), by Henry (E. S. R. 50, p. 116); Climate of San Jose, Calif. (illus.), by Nichols; Group Distribution and Periodicity of Annual Rainfall Amounts (illus.), by R. E. Horton (see p. 415); East Winds on the North Pacific Coast (illus.), by E. L. Wells; and Note on Trade Winds in Hawaii (illus.), by T. A. Blair.

**Weather influences in the British Isles**, C. E. P. BROOKS (*Nature* [London], 112 (1923), No. 2823, pp. 834-836).—It is stated that "the weather of the British Isles, apart from seasonal temperature changes, is almost entirely terrestrial in its control, being dependent on the distribution of pressure over the North Atlantic and Arctic Oceans and the Continent of Europe." The dominant factors of control are "the area of low pressure which is generally found in the neighborhood of Iceland or southern Greenland, and is termed the Icelandic minimum; the area of high pressure which occupies the eastern Atlantic near and south of the Azores, termed the Azores anticyclone; and in winter, the area of high pressure which is centered in Siberia and extends in a west-south-westerly direction towards the Azores anticyclone." If it were possible to forecast definitely the position and intensity of these three centers of action, "we should be well on the road to true long-range weather forecasting." This is not possible with present knowledge, but such information as is now available encourages further research.

The influences which control British weather are so many and so diverse "that small fluctuations of the solar constant elicit no obvious response. . . . Periodicities in weather there undoubtedly are, but they are usually either so small in amplitude as to be of academic interest only or they show baffling changes of phase and amplitude." For example, "the standard deviation from normal of a month's rainfall in London is about 60 per cent, while the variation attributable to the Brückner cycle is less than 3 per cent. A similar criticism applies to Sir William Beveridge's periodicities in the price of wheat."

**The climate of the Netherlands Indies, I-III**, C. BRAAK (*K. Magnet. en Met. Observ. Batavia, Verhandel.* 8 [1921-1923], pts. 1, pp. VI+63+18, pls. 2; 2, pp. III+65-147+19-50, pls. 3, figs. 19; 3, pp. III+149-221+51-89, pls. 7, figs. 3).—These are parts of a general treatise, in the Dutch language with full English summaries, on the climate of the Netherlands East Indian Archipelago. The first part is descriptive of the earlier meteorological work and of the general climatic features of the Archipelago as a whole. The second part deals with the local climate of the different islands. The third part deals, specifically and in detail, with rainfall and the conditions which influence its amount and distribution throughout the Archipelago.

The available data regarding rainfall are summarized as a rule up to 1921. The rainfall varies widely as regards time and place but is generally large, annual rainfalls of less than a meter being a great exception. The greatest rainfall recorded is 6,829 mm. (271.86 in.) and the smallest 530 mm. "When leaving the Equator and approaching Australia, the distribution of rainfall over the year changes more and more. A division into a dry and wet season becomes apparent, which is most clearly marked in the extreme southeast." Excessive droughts occur perhaps once in 10 to 20 years. Among the factors controlling the rainfall which are discussed are (1) condensation in the



tropical rain belt, (2) the monsoons, (3) phenomena during monsoon changes, and (4) local influences. Observations are recorded which show a daily variation of rainfall at sea nearly the reverse of that of typical land stations.

### SOILS—FERTILIZERS.

**The auxotaxic curve as a means of classifying soils and studying their colloidal properties,** A. E. VINSON and C. N. CATLIN (*Jour. Agr. Research* [U. S.], 26 (1923), No. 1, pp. 11-13, figs. 4).—In a contribution from the University of Arizona, four auxograph charts drawn by a few southwestern soils are presented and briefly discussed.

The belief is expressed "that every dry soil on swelling in distilled water at a given temperature will produce a characteristic auxotaxic curve that can be duplicated repeatedly. This curve appears to integrate at least four properties of the soil: Texture, colloidal organic matter, colloidal inorganic matter, and soluble salts, and, indirectly, specific gravity, the original thickness of the 10-gm. disk being determined by this factor. In addition to these properties of the soil itself, the curve integrates temperature, viscosity, and the presence of electrolytes and colloids in the medium in which the swelling occurs. . . . It is believed that if a large number of auxotaxic curves drawn on the same coordinates and representing the recognized soil types were recorded, they could be used in the classification of soils to the greatest advantage along with other methods now in use."

Studies of methods of determining the rate of swelling in soils showed that, while the auxotaxic curve of any soil in distilled water under standard conditions is fixed, it may be modified by the addition of electrolytes, molecules such as sugar, or colloids. Electrolytes in the water accelerate the rate of swelling. Twenty per cent of cane sugar retarded the swelling of calcareous clay. Small amounts of gelatin accelerated the rate of swelling, and large amounts retarded it. "The fact that the same concentration of colloid has a markedly different effect on the rate of expansion of different soils suggests that here also may be found another means of studying the colloidal properties of different soils. Small amounts of electrolytes accompanying strong solutions of gelatin also greatly modify its effect."

An instance is cited in which the lateral crushing of a tile line was explained by the auxotaxic curve.

**Methods of measuring the plasticity of clays,** F. P. HALL (*U. S. Dept. Com., Bur. Standards Technol. Paper 234* (1923), pp. 345-366, figs. 9).—Criticisms concerning the more important methods of measuring the plasticity of clays are given in the first part of this publication. The second part is devoted to the presentation of experimental data collected with the use of the Bingham plastometer, an instrument which has been recently brought forward for measuring the plasticity of paints, greases, and other semirigid materials, and which, in effect, is a modified capillary tube viscosimeter.

The survey of the methods for measuring plasticity led to the conclusion that none of them is entirely satisfactory, and that plasticity is a resultant of two factors and perhaps more. It was very difficult to obtain concordant results with most of the methods, and on account of the heterogeneity of the system clay-water it was very difficult to formulate mathematical equations that would satisfy the observations. It was possible to detect slight changes of consistency in clay slips with the Bingham plastometer. It is believed possible to determine roughly the relative plasticities of clays when comparing plastometer curves over the same range of flow and with the same capillary, but the results are not independent of the dimensions of the capillary used. They are

thus empirical, and are comparable only when they are obtained with the same capillary.

It is considered highly probable that with the use of some type of plasto-meter other than the capillary tube type absolute values of the two plasticity components, namely, yield value and mobility, can be determined, but that with the capillary tube type the case is complicated by the presence of such phenomena as slippage, end effects, etc.

**On the mechanical analysis of soil containing heavy minerals,** B. DE C. MARCHAND (*So. African Jour. Sci.*, 18 (1922), No. 3-4, pp. 223-226).—An attempt is made in this article to solve the problem of the mechanical analysis of soil containing heavy minerals. It is shown that the whole question is complicated by the nature of the heavy mineral present, and that when the proportion of such modifying constituents is large, mechanical analysis is almost worthless as a basis of comparison.

**The value of mineralogical examination in determining soil types, with a method of examination and a comparison of certain English and Scottish soils,** J. HENDRICK and G. NEWLANDS (*Jour. Agr. Sci. [England]*, 13 (1923), No. 1, pp. 1-17, fig. 1).—In a contribution from the North of Scotland College of Agriculture and the University of Aberdeen, the results of examinations of soils from a number of different localities in England and representative of a number of different types are reported.

A mechanical analysis was first made, and the resulting fine gravel, coarse sand, and fine sand, after ignition, were further separated by means of the heavy liquid bromoform into three mineral groups, which comprised the orthoclase group characterized by potash feldspar, the quartz group characterized by quartz, and the ferrosilicate group characterized by ferromagnesian silicates and iron oxides.

It was found that the soils, all more or less of glacial drift origin, differed considerably in mineral content. This depended upon the nature of the rock from which the drift was derived. Soils arising from glacial drift, originally of sedimentary formation, were generally composed almost entirely of quartz with comparatively small amounts of silicates, while at the other extreme soils of which the original material was of basic igneous formation contained almost no quartz and were rich in silicates. By means of the methods of separation used, combined by microscopic examination, it was found possible to contrast mineralogically certain English and Scottish soil types. The fine sand obtained by mechanical analysis proved most useful for this purpose.

The results as a whole are taken to indicate that a short mineralogical examination affords a useful method of grading soils according to the reserve of bases which they contain in the form of silicates, and of distinguishing those which have little of such reserve from those which have rich reserves of the principal bases required by plants.

**Livingston County soils,** J. G. MOSIER, S. V. HOLT, F. A. FISHER, E. E. DE TURK, and H. J. SNIDER (*Illinois Sta. Soil Rpt.* 25 (1923), pp. 55, pls. 4, figs. 4).—This survey deals with the soils of an area of 659,041 acres lying entirely within the Wisconsin glaciation in northeastern Illinois, and reports chemical analyses of the prevailing soil types. The topography varies in general from flat to rolling. Apparently the entire county is well drained.

The soils are grouped as upland prairie, upland timber, terrace, swamp, and bottom land, and residual soils. The upland prairie soils cover the greater part of the area and the brown silt loam and black clay loam are the prevailing types, covering 75.3 and 15.9 per cent of the area, respectively.



A general discussion of the important principles of soil fertility is appended, and data from experiment fields on the crop adaptations and fertility requirements of the prevailing soil types are embodied in a supplement.

**Sandy soils of northern Michigan**, M. M. MCCOOL (*Michigan Sta. Quart. Bul.*, 6 (1923), No. 2, pp. 64-66, fig. 1).—The results of some of the studies of the sandy soils of northern Michigan are briefly presented, indicating that the agricultural value and moisture-holding capacity depend largely upon the thickness and nature of the brown layer.

**Soils in relation to forestry**, J. O. VEATCH (*Michigan Sta. Quart. Bul.*, 6 (1923), No. 2, pp. 67-69).—The results of recent studies are briefly summarized, suggesting a correlation between soil types, forest types, and plant associations in the State.

**Soil survey of St. Louis County, Mo.**, H. H. KRUSEKOPF and D. B. PRATAPAS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1919, pp. III+517-562, pls. 4, fig. 1, map 1).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 360,960 acres lying at the northeast edge of the Ozark region in east-central Missouri. Approximately three-fourths of the county, including the northern and eastern parts, is pre-vaillingly gently rolling. The southwestern part of the county is hilly. The drainage of the entire county flows through short streams into the Missouri, Mississippi, and Meramec Rivers.

The upland soils of the county are said to be predominantly brown in color, silty in texture, well drained, and of great depth. The principal soil material is loess, and differences in soil character are mainly due to weathering rather than to origin. Including rough stony land and riverwash, 26 soil types of 19 series are mapped, of which the Memphis and Clinton silt loams cover 31.4 and 13.2 per cent of the area, respectively.

**Soil survey of Onslow County, N. C.**, R. C. JURNNEY ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1921, pp. III+101-127, fig. 1, map 1).—This survey, made in cooperation with the North Carolina Department of Agriculture and the North Carolina Station, deals with the soils of an area of 480,000 acres in the Coastal Plain region in southeastern North Carolina. The topography varies from flat to gently rolling and rolling. It is stated that natural drainage has not been established over a large part of the county.

The soils are derived from unconsolidated sands, sandy clay, and clay. Including muck, swamp, tidal marsh, and coastal beach, 22 soil types of 13 series are mapped, of which the Norfolk fine sand constitutes 15 per cent of the area and is the most extensive type. The Norfolk fine sand and fine sandy loam, Dunbar and Onslow fine sandy loams, and Susquehanna clay loam are the important agricultural soils.

**Piedmont peat [Italy]**, T. SOLA (*Staz. Sper. Agr. Ital.*, 55 (1922), No. 1-3, pp. 29-33).—A brief study of the peats of the Piedmont section of northwestern Italy is presented, including chemical analyses of nine samples. These showed that the ash content of these samples varied from 10.94 to 41.94 per cent. The calorific power of the peat gas ranged from 4,850 calories per cubic meter in the peat containing 10.94 per cent of ash to 2,763 calories in that containing 41.94 per cent of ash. The sulphur content was relatively low, while the nitrogen content was relatively high. It is concluded that this material is susceptible of profitable industrial development.

**Soil survey notes.**—**The Darrang District**, H. R. COOPER and C. R. HARLER (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, 1923, No. 1, pp. 20-30, pls. 3).—This paper deals with the soils of the Darrang District, which is a strip of land lying between the Brahmaputra River and Himalaya Mountains. These soils



include infertile sandy soils, rich loams, and old red soils. Tabular and other data on the mechanical and chemical composition of these soils are included.

**Some observations on barren soils of lower Bari Doab Colony in the Punjab,** S. M. NASIR (*Agr. Research Inst., Pusa, Bul. 145 (1923), pp. [1]+11*).—This report deals with the physical, chemical, and biological properties of the arid soils of an area of about 300,000 acres in the Punjab.

Chemical studies indicated that the infertility of these soils is due to the fact that the total water-soluble alkali salts are very high and are sufficient to prevent crop production. In this connection it is shown that the contents of chlorids and sulphates are much above the toxic limits.

No active bacteria were found on examining an aqueous suspension of the soil under the microscope. Microscopic examination of soils inoculated with six different soil organisms showed that after three days' incubation the organisms in the original set had already perished, while where conditions were made suitable by neutralizing the excess of alkali they were able to continue their existence, although the growth was retarded.

Ammonification studies showed that, while the figures for ammonification in the case of alkali soil were very low in comparison with those for normal soil, the ammonifying bacteria were still active and able to tolerate large quantities of toxic salts, in the presence of which higher plants could not flourish.

Reclamation experiments indicated that the most efficient and economical way to restore soil fertility and to remove the toxic agents is the installation of artificial drains and the application of gypsum, followed by flooding with water, thus removing the alkali salts from the soil entirely.

**Representative Transvaal soils.**—IV, The high veld sandy soil, B. DE C. MARCHAND (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 1, pp. 82-85).—In the fourth contribution to the subject (*E. S. R.*, 46, p. 712), data on the nature, origin, and mechanical and chemical composition of the high veld sandy soil occurring on the high veld of the Pretoria, Middelburg, Bethal Ermelo, Carolina, and Heidelberg districts are presented. This soil is said to be gray, brownish-gray, or occasionally red in color and is light in texture, but passes in many cases into a sandy loam. A sharp distinction can generally be drawn between the soil and subsoil.

The mechanical analyses indicated that this soil is a sand of medium texture. The percentage of clay was very much higher in the subsoil than in the surface soil, and the subsoil is classed as sandy loam. A considerable portion of the clay in these subsoils consisted of finely divided hydrated ferric oxid. The surface soil was extremely pervious to water and the subsoil considerably less so.

The chemical analyses indicated that the percentages of lime and magnesia were invariably low, and the soil had the character of one from which all basic material had been removed by leaching. The reaction was always decidedly acid, and in many places, due to the accumulation of sour humus, the high veld sandy soil passed into an extremely acid peaty soil. The percentage of potash present was very moderate, and there was a marked deficiency in phosphoric acid.

Brief information on the fertility treatment of this soil is presented.

**The measurement of the H-ion concentration in South African soils in relation to plant distribution and other ecological problems,** J. W. BEWS and R. D. AITKEN (*So. African Jour. Sci.*, 19 (1922), pp. 196-206).—Some of the preliminary results of studies of the H-ion concentration of certain South African soils are presented and discussed, with particular reference to the influence of soil acidity on plant distribution.



Samples of low veld soils were found to be slightly acid, while a typical sample taken from under a specimen of thorn tree proved to be neutral. High veld soils from an altitude of about 4,300 ft. on steep slopes showed a very acid reaction, while soil from the center of the bush on lower slopes was neutral. While all high veld soils are acid, forest soils on the whole are apparently not so acid as open grass veld soils. Soils from an open grassy north slope were considerably more acid than those from a forested south slope.

Suggestions for future studies are included.

**The moisture equivalent of heavy soils**, A. F. JOSEPH and F. J. MARTIN (*Jour. Agr. Sci. [England]*, 13 (1923), No. 1, pp. 49-59, fig. 1).—Studies conducted at the Wellcome Tropical Research Laboratories at Khartum on the relations between the moisture equivalent of soils and such soil properties as salinity and alkalinity are reported. The soils used were for the most part very heavy, consisting of over 50 per cent clay, and were usually situated under climatic conditions necessitating the use of heavy irrigation.

The results indicate that the moisture equivalent of a normal soil diminished as the weight of soil taken for the determination increased. Some soils were found to be particularly impervious to water in thick layers. In these cases the moisture equivalent increased as the weight of soil taken and sometimes became very large owing to water-logging. Dilute solutions of flocculating salts, such as calcium sulphate or ammonium nitrate or sulphate, reduced and sodium carbonate increased the moisture equivalent.

The effect of sodium carbonate was complicated. With gradually increasing concentration, the moisture equivalent first diminished and then increased to a maximum, after which there was further diminution. Soil samples which easily showed water-logging in the Briggs-McLane apparatus had a higher concentration of OH ions than those which did not. While the colloidal content of a clay seemed related to its moisture equivalent, no such connection appeared to exist for substances such as kaolin or aluminum hydroxid.

A brief description of certain experimental methods used is appended.

**The clover v. timothy rotation experiment on the station farm at Geneva**, R. C. COLLISON and J. D. HARLAN (*New York State Sta. Tech. Bul.* 94 (1923), pp. 6, 36-40).—This is a brief statistical study of experiments reported in Bulletin 465 of the station (E. S. R., 42, p. 326).

**Fertilizer experiment with hot composted stable manure**, O. KRON (*Mitt. Deut. Landw. Gesell.*, 38 (1923), No. 28, pp. 380-384, figs. 2).—This is a report of the second year of experiments with composted stable manure, previously reported by Bornemann (E. S. R., 46, p. 818).

The results of two years' experiments with wheat and of one year with potatoes indicate that the fertilizer value, with special reference to the nitrogen content, of artificially composted stable manure is about twice that of ordinary manure which has not been composted. It was noted that the losses of nitrogen through composting were from 15 to 20 per cent as compared to a loss of more than 30 per cent from stable manure conserved by other methods. The use of a so-called manure silo for composting is briefly discussed.

**Cause of nitrogen losses from urine, solid manure, and other organic substances**, O. NOLTE (*Landw. Vers. Sta.*, 99 (1922), No. 4-5, pp. 287-292).—Studies are reported which indicated that there is apparently no relation between nitrogen losses and the formation and subsequent destruction of nitrates in liquid and solid manures, urine, etc. It was found that nitrogen losses from stored manure were less under anaerobic than under aerobic conditions.

**Fertilizer plat experiments on the station farm at Geneva**, R. C. COLLISON and J. D. HARLAN (*New York State Sta. Tech. Bul.* 94 (1923), pp. 6, 7, 40-



56, 61-64, fig. 1).—The results of eight years of fertilization experiments on 104  $\frac{1}{10}$ -acre plats on a part of the station farm are reported. The soil was made up of Ontario loam and Dunkirk clay loam of rather high productivity. The plats were divided into six series, two of which were cropped with a rotation of corn, oats, and two years of alfalfa, and had a fertilization plan different from the other four series which were cropped with a rotation of potatoes, wheat, and two years of alfalfa.

The alfalfa maintained the production level without a falling off during the 8-year period, but whether or not at the expense of soil nitrogen could not be stated definitely. The element most needed seemed to be potassium, although the total supply of potassium was large. A need for this element in available form was evident in all the plat series, but not on all crops in all series. The soil did not respond definitely to phosphorus, although when acid phosphate was applied with manure a large increase over manure alone was secured on oats and alfalfa.

Nitrogen applied with phosphorus gave increased yields on potatoes but not on any of the other crops. The response of crops to nitrate applications was not marked, although the two series on the soil with the highest total nitrogen content responded least to the application of sodium nitrate.

Rock phosphate applied at the rate of 1,000 lbs. per acre proved as efficient a source of phosphorus on this soil as acid phosphate at the rate of 600 lbs. per acre, although this comparison was made on a soil which did not respond definitely to applications of phosphorus. Gypsum at the rate of 1,000 lbs. per acre was apparently not beneficial in increasing crop yields either when added alone, with rock phosphate, or in a complete fertilizer.

“Field experiments need better planning and more rigid control, rather than radical changes in the field method of research. Many of the more exact laboratory methods might well be applied to field work and still keep the plant and the soil in their natural environment.”

[Chemical studies on the general fertilizer plats at the Pennsylvania Station], J. W. WHITE and F. J. HOLBEN (*Pennsylvania Sta. Bul.* 181 (1923), pp. 8-11).—Studies of the organic matter of composite samples taken in 1921 from plats treated with manure showed that after 40 years of continuous cropping an average of 85 per cent of the organic matter applied was lost from the soil. The plat treated with lime and manure showed more residual organic matter than where the same amount of manure was used alone. The heavier the manure application the greater was the relative loss of applied organic matter. Plats treated with sodium nitrate and ammonium sulphate contained less organic matter than plats receiving no nitrogen but otherwise treated the same. Soils treated with nitrogen, phosphorus, potash, nitrogen and potash, limestone, and land plaster contained less residual organic matter than those of the untreated plats. Soils treated with land plaster, nitrogen, burnt lime, limestone, and potash contained less residual active humus than those of the untreated plats.

Nitrogen studies showed that after 40 years of continuous cropping an average of 63 per cent of the total nitrogen applied in manure and of 74 per cent applied in mineral fertilizer had been lost from the soil. Soils treated with land plaster, nitrogen, potassium, phosphorus, burnt lime, pulverized limestone, nitrogen and potash, nitrogen and phosphorus, and 48, 72, and 24 lbs. of nitrogen in ammonium sulphate contained less residual nitrogen than soils treated with phosphorus and potash only. Plats treated with manure showed a 13 per cent increase in nitrogen over the complete fertilizer plats, and plats treated with complete fertilizers showed only 52 lbs. per acre of nitrogen more than the phosphorus-potash treated plats. Soils treated with lime and 6



tons of manure contained more residual nitrogen than those treated with 6 tons of manure without lime.

Comparative studies with burnt lime and limestone showed that, after 40 years of cropping, the plats treated with burnt lime contained as much organic matter as the limestone plats.

Studies of the organic matter and nitrogen contents of the soil in permanent sod as compared to a 4-year rotation system showed that after 41 years of cropping the grassland soil contained more organic matter, active humus, and nitrogen in every case, and that land kept in permanent sod, where the surface was undisturbed by tillage, maintained its organic matter content better than a rotation system even where manure was applied.

Comparative studies of acid phosphate and rock phosphate on three soil types showed that acid phosphate produced an average of 17 per cent more grain and 13 per cent more clover and timothy hay than rock phosphate. On DeKalb soil, acid phosphate produced 22 per cent more Kentucky blue grass hay, while rock phosphate produced 115 per cent more sweet clover hay when applied in amounts sufficient to furnish four times as much phosphorus as applied in acid phosphate. Data on the relative values of hydrated lime and pulverized limestone in the production of corn, wheat, oats, and hay on three different soils were somewhat in favor of the hydrated lime.

**Importance of the use of nitrogenous commercial fertilizers**, O. ENGELS (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 10, *Wirtschaft.-Prakt.*, pp. 457-478).—Considerable experimental data from different sources are briefly summarized in support of an argument for a more general and more efficient use of nitrogenous fertilizers in German agriculture. The opinion is expressed that for many crops and soils the maximum efficiency of nitrogenous fertilizers has not been reached.

**Nitrogen fertilization experiments of the Deutsche Landwirtschafts-Gesellschaft during 1922**, O. NOLTE (*Mitt. Deut. Landw. Gesell.*, 38 (1923), No. 32, pp. 429-436).—The results of a large number of experiments with ammonium sulphate, sodium nitrate, lime nitrogen, and ammonium sulphate nitrate on such crops as rye, oats, sugar beets, and potatoes on a wide range of soils are summarized in tabular form. The fertilizers were applied in increasing amounts, partly as top-dressings and partly mixed in the seed bed.

It is noted that the yields obtained with nitrogenous fertilizers were in general rather large. This is taken to indicate the importance of nitrogen in German agriculture. The results showed that previously assumed practical maximum applications of nitrogenous fertilizers for these crops on the soils used are generally incorrect and frequently too small.

**Action of physiologically acid and alkaline nitrogen fertilizers**, F. MÜNTER (*Deut. Landw. Presse*, 49 (1922), Nos. 83-84, pp. 534, 535; 85-86, p. 543).—Experiments begun in 1920 at the agricultural experiment station at Halle, to determine the influence of physiologically differently acting nitrogenous fertilizers on the action of phosphatic fertilizers and their assimilation by such crops as wheat, are briefly reported. The soil used was a mixture of one-third sandy loam and two-thirds sand.

The results showed that ammonium sulphate favored the assimilation of phosphoric acid by wheat, while sodium nitrate hindered it. Lime also tended to hinder assimilation. Fertilization with both lime and sodium nitrate had the most injurious influence, both on yield and phosphoric acid assimilation. The results also indicated that the amounts of fertilizer used in actual practice on the better soils will have much less influence on the soil processes than the large amounts used in pot tests with sandy mixtures. Long-time experiments with several other crops generally showed greater yields with



sodium nitrate than with ammonium sulphate. However, when ammonium sulphate was used with Thomas meal it gave larger yields.

**Action of sodium nitrite in the soil**, R. H. ROBINSON (*Jour. Agr. Research* [U. S.], 26 (1923), No. 1, pp. 1-7).—Studies conducted at the Oregon Experiment Station to determine whether nitrites, when used in quantities comparable to those used as a fertilizer, will change rapidly to nitrates in clay loam, gravelly loam, brown clay loam, and medium sandy loam soils are reported.

The results showed that sodium nitrite is rapidly decomposed in acid soils and the nitrite nitrogen lost. The nitrite nitrogen is gradually lost in neutral soils and more slowly in alkaline soils. The oxidation of nitrites to nitrates was nil under the experimental conditions. The addition of calcium carbonate and calcium hydroxid to the acid soils retarded the decomposition of nitrites, but did not aid their nitrification. It is considered inadvisable to apply a fertilizer composed mainly of sodium nitrite to an acid soil.

**Utilization of synthetic urea as a nitrogenous fertilizer**, G. CHEVALIER (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 44 (1923), No. 36, pp. 257-260, fig. 1).—Pot tests of urea on washed sand are briefly reported, showing that in comparison with six other common nitrogenous fertilizers it had a progressively favorable influence on the growth and yield of wheat. It is concluded that synthetic urea is a fertilizer comparable in effectiveness and economy to sodium nitrate.

**A field test of different carriers of phosphorus**, F. D. GARDNER (*Pennsylvania Sta. Bul.* 181 (1923), pp. 6, 7).—The progress results of experiments begun in 1920 showed that when used without manure acid phosphate was much more effective than rock phosphate on wheat following corn, but when used with manure the difference in yield between these two sources of phosphorus was less marked. Flour of sulphur applied with rock phosphate increased the availability of the phosphorus, as indicated by better yields of wheat.

**Phosphoric acid fertilization once and now**, O. NOLTE (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 8, *Wirtschaft.-Prakt.*, pp. 373-388, fig. 1).—The history of the development and use of phosphoric acid fertilizers is briefly outlined and discussed.

**The basis of the present fertilizer industry—acid phosphate**, W. H. WAGGAMAN and H. W. EASTERWOOD (*Chem. and Metall. Engin.*, 29 (1923), No. 12, pp. 528-532, figs. 4).—In a contribution from the U. S. D. A. Bureau of Soils, the manufacture of acid phosphate is briefly described as a huge industry that does credit to the engineer and the plant manager but involves a tremendous waste of raw material at the mine and losses due to inadequate fundamental research. It is concluded that, from the standpoint of the efficient use of raw materials and the economical handling and shipping of the finished product, acid phosphate does not measure up to the other manufactured fertilizer materials.

**Potash from kelp: Early development and growth of the giant kelp, *Macrocystis pyrifera***, R. P. BRANDT (*U. S. Dept. Agr. Bul.* 1191 (1923), pp. 40, figs. 16).—Following an introduction by J. W. Turrentine, the results of two years' study of the life history of the giant kelp, *M. pyrifera*, undertaken as a part of the broader study of the economic utilization of the giant kelps of the Pacific for the manufacture of potash, are presented.

These showed that kelp grows only where it has good anchorage, the most favorable depth of water being from 40 to 50 ft. A temperature above 25° C. (77° F.) destroys it, storms tear out many plants, but wind, currents, and waves favor growth. The heaviest mats of kelp are seen late in autumn and again in spring, fruit being most abundant in winter.



Macrocystis branches by the splitting of its leaves, a frond living from four to seven months, and a new frond growing up when an old one perishes. It may die and disappear suddenly when conditions are very unfavorable for growth, and gradually under less adverse conditions. Black rot is the most important natural destroyer of kelp, destroying many floating fronds in warm calm water where no cutting is done. Harvesting apparently controls the disease, and thorough cutting through periods of from two to four weeks, at intervals of from three to four months, is beneficial.

**The yield-increasing action of silicic acid in the presence of insufficient phosphoric acid for plant nutrition,** O. LEMMERMANN and H. WIESSMANN (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 4, Wiss., pp. 185-255, figs. 18).—Studies are reported, the results of which showed that silicon in proper form is able under certain conditions to increase crop yields materially.

The most marked yield-increasing effect of silicon occurred when there was a deficiency in phosphoric acid. This effect was much less when there was a deficiency in potash and was absent when there was a deficiency in nitrogen. Silicon apparently had a favorable influence upon crop yield even when fertilization including considerable phosphoric acid had been practiced.

Colloidal silicic acid gave the best results on quartz sand of any of the silicon compounds tried, and apparently it had a directly favorable action on the crop. Silicic acid apparently did not increase the yield of grasses, but increased the yields of legumes and cruciferous plants. In several cases as high yields were obtained where silicic acid was added with phosphoric acid as where three times as much phosphoric acid was added alone. The greater the amount of silicic acid available to the crops the greater was the total crop yield and the smaller was the increase in yield produced by additional phosphoric acid fertilization.

Phosphoric acid fertilizers apparently had a better effect the greater the amount of silicic acid they contained. The active value of phosphoric acid in a medium containing no available silica was quite different from that in a medium containing more or less available silica. The practical significance of these results is discussed.

## AGRICULTURAL BOTANY.

**Some observations on the temperature of the leaves of crop plants,** E. C. MILLER and A. R. SAUNDERS (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 1, pp. 15-43, figs. 8).—While engaged in investigating the water relations of various crop plants at the Kansas Experiment Station the authors, by means of a thermoelectrical device which is described, made a study of the relationships of the temperature of the air to that of attached leaves of corn, sorghum, cowpeas, soy beans, alfalfa, pumpkin, and watermelon growing under field conditions. The temperature of the leaves was studied to determine the relation of leaf temperature to the rate of transpiration, the temperature of the leaves during the day and night, the temperature of different portions of the leaf, and the temperature of the leaves in direct and in diffuse sunlight.

It was found that the temperature of a leaf is influenced by the temperature of the air, by the available water supply in the soil, by air currents, by the type of the leaf, by the intensity of the light to which it is exposed, and by other factors. Under ordinary field conditions during the daylight hours, the temperature of the leaves and of the surrounding air was found not to be constant even during so brief a period as a few seconds, but to show sudden and marked fluctuations that may vary as much as 4° C.



For a large number of determinations during the hours from 9 a. m. to 4 p. m. the average temperature of the wilted leaves of corn, sorghum, soy beans, and cowpeas was found to be 1.85, 1.55, 2.8, and 4.65° higher than the temperature of the turgid leaves of these plants under the same conditions, with the exception of the amount of water in the soil. During the transpiration-temperature experiments the percentage of available water in the soil above the wilting coefficient was from 2 to 4 per cent for the wilted plants and from 10 to 12 per cent for the turgid ones. The average transpiration rate of the turgid leaves was much higher than that of the wilted leaves, the ratio of the rate of transpiration of the turgid leaves to the rate of transpiration of the wilted leaves being 2.5:1 in the case of corn and sorghum and 3.5:1 in the case of cowpeas and soy beans.

During the hours of early morning and evening and when the general climatic conditions were relatively mild, the temperature of the turgid leaves was slightly below the temperature of the surrounding air. During the night the temperature was approximately the same as that of the surrounding air. During the day, however, from 9 a. m. to 4 p. m., different species of plants showed a different behavior of the temperature relationship of their turgid leaves and the surrounding air. The temperature of the turgid leaves of corn, sorghum, pumpkin, and watermelon in direct sunlight was found to fluctuate slightly above or below air temperature, but the average temperature of the leaves was approximately that of the surrounding air.

The experiments with the leaves in direct sunlight showed that the temperature of the base of the leaf was always lower than the temperature of the tip region, the difference varying from 1 to 1.5°, depending upon the nature of the leaf and upon the available water supply.

The data obtained are said to show that in diffuse sunlight the temperature of attached turgid leaves of the plants studied was always lower than that of the surrounding air, the average difference being from 0.1 to 3°, with a maximum difference of 5°. In direct sunlight the temperature of the turgid leaves of most plants fluctuated above and below the air temperature, but as soon as a cloud obscured the sun the leaf temperature was found to drop below the temperature of the air almost immediately and to remain there until the leaf was again exposed to direct sunlight.

**Limiting temperatures for growth and life in the Saccharomycetes and the corresponding cell size and form characters as criteria for classification,** H. WILL (*Centbl. Bakt. [etc.]*, 2. Abt., 55 (1922), No. 21-24, pp. 465-480).—The four Saccharomycetes studied were found to yield usable data as diagnostic criteria in response to the methods employed, which are indicated.

**The use of the methods of colloid chemistry in phytopathology,** F. BOAS and F. MERKENSCHLAGER (*Centbl. Bakt. [etc.]*, 2. Abt., 55 (1922), No. 21-24, pp. 508-515, figs. 3).—Expressed sap of young seedlings of *Lupinus luteus* shows clearly the alterations caused by the action of certain salts on the colloidal constituents of the plasma. The cations of the alkaline earths, particularly calcium, cause an immediate and striking flocculation of nitrogenous materials. The structure of protoplasm is thought to be profoundly altered in the presence of the alkaline earths. Since normal life activities are closely bound up with certain structures, it is apparent that lupines, which have very calcium-sensitive nitrogenous components, are susceptible to injury by very small additions of calcium. The destructive effects of the cations of the alkaline earths on lupines may be strikingly demonstrated in the laboratory.

The lime sensitiveness of lupines is related to the cations. Both calcium and magnesium cause profound alterations as to physical conditions in the smallest collections of nitrogenous materials. Lack of carbohydrate becomes



more important as a factor under such conditions. The plasma, showing a partial flocculation of its proteins, undergoes increased alteration and defunctionalization. For example, the mobilization of iron is lessened.

The injurious effects observed in cultures of calcium and magnesium are, therefore, explained by their severely flocculating effect.

**The chemistry of the vegetable cell**, V. GRAFE (*Chemie der Pflanzenzelle*. Berlin: Borntraeger Bros., 1922, pp. VIII+420, figs. 32; rev. in *Bot. Gaz.*, 74 (1922), No. 2, p. 222).—This book, delayed as to its appearance for about eight years by conditions in Europe, has been revised before publication so as to include results of more recent work of fundamentally important character.

The subject matter is grouped under the headings of the physicochemical laws of cell phenomena, light and heat as energy factors, the cell wall, the protoplasm, and dynamic chemistry. The first two sections deal with the problems of diffusion and osmosis, the colloidal state, imbibition, adsorption, electrolytic dissociation, energy transformations, and catalysis. The third deals with the structure, composition, and chemical transformations and modifications which occur in the walls of cells during development and maturation. The fourth considers the colloidal structure, chemical constitution, enzymes, toxins, precipitins, and pigments of the cell, particularly the chlorophyll and anthocyanin pigments. The last and longest section considers the chemical transformations of cell activity.

The book is intended as a general text for students. The list of literature comprises nearly 1,000 references, some of which are not considered in the text.

**Studies on cell structure in Iris**, P. A. DANGEARD (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 26, pp. 1653-1659, figs. 2).—A further development is attained of the study and description previously indicated (*E. S. R.*, 44, p. 822) of cellular elements, the changes and relations referring here more particularly to *Iris*.

**Chemical studies on safflower seed and its germination**, V. A. TAMHANE (*India Dept. Agr. Mem., Chem. Ser.*, 6 (1923), No. 7, pp. [2]+223-244, pl. 1).—It is stated that the safflower seed contains reserve materials chiefly in the form of oil and protein matter. In the resting seed there is no starch, glucosid, or tannin and but a small proportion of nonreducing sugars capable of inversion, with probably no cane sugar.

The experiments cited led also to the conclusion that not all acidification of the oil during germination was due to enzymic action, though what the other cause may be has not yet been ascertained. Furthermore, the action of the lipase seems to be a terminable one, hence the effect produced is limited.

**Carbon assimilation**, D. THODAY (*So. African Jour. Sci.*, 19 (1922), pp. 52-63).—This is largely a synthetic and critical review, with implications and inferences, of recent findings by workers named regarding some of the fundamentals of carbon assimilation, that is, the factors, stages, rates, and limitations involved.

**Pseudo bases of anthocyanidins in plant tissues**, R. COMBES (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 1, pp. 58-61).—In the course of studies as here outlined, on relations between the tannins and the anthocyanic pigments, the author has obtained results tending to indicate that the substances considered by Noack (*E. S. R.*, 42, p. 129) as pseudo bases of anthocyanidins are really phlobatannins.

**Observations as to the optimum altitude for flower coloration**, J. BOUGET (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 26, pp. 1723, 1724).—The experiments here noted as made with various plants are said to add new examples to those cited by Bonnier (*E. S. R.*, 7, p. 653) regarding an optimum



altitude for leaf coloration, and to show by clear cases that the optimum altitude for coloration varies with species.

**The effect of late frost on the wood of *Acer pseudoplatanus*,** J. TEMPLETON (*Notes Roy. Bot. Gard. Edinb.*, 14 (1923), No. 66, pp. 9-12, pls. 3).—Examination of abnormalities of growth ring formation in the wood of *A. pseudoplatanus* appears to have shown that a frost period, March 30 to April 6, 1897, affected growth, interrupting the continuity of the medullary rays and restricting the inward passage of sugar to the extent that the internal economy of the tree was impaired and a region of weakness developed as a consequence.

**The root system of *Epigaea repens* and its relation to the fungi of the humus,** W. T. COUNCILMAN (*Natl. Acad. Sci. Proc.*, 9 (1923), No. 8, pp. 279-285, figs. 4).—The author reports a study of the relations between *E. repens* and the fungi investing its roots, more particularly the very fine roots which are devoid of root hairs and very favorable for the investigation of such a relationship. The hyphae, in all places where most abundant, penetrate between the cells covering the roots and may extend in the tissue beneath them. They give off fine haustoria often with clubbed ends penetrating the cells, the contents of which here appear more granular, these cells also appearing larger. The rapidly dividing hyphae often form what is called a glomerulus.

Plants examined from localities in Maine, Massachusetts, Maryland, and northern Japan show essentially similar characters, this fact suggesting that this close relationship has existed during a very long portion of geologic time. From this and other facts it can not be assumed that the relationship is pathogenic in the usual sense. No plant lacks the fungus, and plants are vigorous in proportion to its abundance. The impression is strong that the fungus is here as definite an entity as the plant and the union no chance association. The question is raised, among others, whether the intracellular bodies observed represent a food supply for the plant which is taken up in such special activities as blooming and seeding.

**Volutin in fungi,** ZIKES (*Centbl. Bakt. [etc.]*, 2. Abt., 57 (1922), No. 1-3, pp. 21-45).—Method and results are outlined of a study on the presence and production of volutin in plants, with reference to temperature and other conditions. Volutin is produced on most fungi studied in minute quantity only. Young cells contain volutin in minute drops. These coalesce to form larger drops which disappear from older cells.

**Energy ratio in growth of *Aspergillus niger*,** E. F. TERROINE and R. WURMSER (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 22, pp. 1435-1437).—A utilization rate of 66 to 70 per cent was reached with *A. niger*, in continuation of studies previously noted (*E. S. R.*, 50, p. 125).

**[Production of anomalies in plants grown in salt water],** P. LESAGE (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 1, pp. 56-58).—Seeds of *Lepidium sativum*, showing in 1920 anomalies as noted previously (*E. S. R.*, 47, p. 224), when cultured in three lots gave for the first, in salt water (1.2 per cent), 10 anomalous seeds on 11 plants; for the second, in spring water, 1 on 22 plants; and for the third, under the same condition, no anomaly out of 11 plants. These facts would indicate that mutation is not here involved.

**The action of chlorin and other gaseous bodies on higher plants,** P. GUÉRIN (*Ann. Sci. Agron. Franc. et Étrangère*, 6. ser., 38 (1921), No. 1, pp. 10-19).—Experimentation is briefly described, with discussion, in connection with observations made partly during the recent war, as showing the effects of chlorin in particular, also of other gases or vaporous poisons on several higher plants.

**Inventory of seeds and plants imported by the Office of Foreign Seed and Plant Introduction during the period from April 1 to June 30,**



**1922** (*U. S. Dept. Agr., Bur. Plant Indus. Inventory No. 71* (1923), pp. 111+62, pls. 6).—Notes are given on 600 lots of seeds and plants introduced between April 1 and June 30, 1922, for testing in the United States.

### GENETICS.

**Biometrical studies on sweet cherries (*Prunus avium*) and sour cherries (*P. cerasus*)**, F. KOTOWSKI (*Pam. Państw. Inst. Nauk. Gosp. Wiejsk. Puławach* (*Mém. Inst. Natl. Polonais Écon. Rurale Puławy*), 1 (1921), A, No. 2, pp. 213-224).—Variability of fruit and leaves in black sweet cherries occurs according to normal unimodal frequency curves with a certain skewness, which is positive in fruit and negative in leaves, the coefficient of variability being twice as small in fruit.

**The variability of monstrosities with special reference to some investigations with swine**, F. ALVERDES (*Anat. Anz.*, 57 (1923), No. 1-2, pp. 1-17, figs. 14).—An anatomical study of the feet and legs of five abnormal pigs from one litter is reported from the Zoological Institute at Halle. All of these pigs were abnormal as to the formation of the digits of one or more of their feet. In some cases two or more digits were combined, with or without a splitting of the bones of the phalanges near the distal end. In others the digits were divided. The abnormalities were not uniform for all the feet of any of the pigs. In some cases two or more bones of the carpus and tarsus were fused into one bone, and in one pig the carpus consisted of only two bones. The radius and ulna, as well as the tibia and fibula, were also fused in certain of the legs. The femur and humerus of some of the pigs were distorted so that the femur consisted merely of an egg-shaped bone in one leg, whereas it was normal in the other leg of the same pig.

The author discusses several theories which might account for the occurrence of these five abnormal pigs in one litter, but is unable to arrive at any satisfactory conclusion.

**The cause of giant and dwarf growth in the domestic fowl**, B. RENSCH (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 31 (1923), No. 3, pp. 268-286, figs. 3).—In a histological study of the difference between the larger and smaller breeds of poultry, the author made observations on newly hatched chicks, 10-day incubated eggs, and the nuclear disk of the fresh eggs of the following breeds: Brahmas, Orpingtons, and Plymouth Rocks representing the large breeds, Leghorns representing an average size, and Mille Fleurs, Campine bantams, German bantams, and Wyandotte bantams representing the small breeds.

In the newly hatched chicks the size of the nuclei of the liver and kidney cells was determined, and it was found that they were significantly larger in the large breeds than they were in the bantams. The number of cells counted in the cross section of a round bone of Brahmas was about twice as great as was observed in individuals of the Mille Fleur breed. The Leghorn was midway between the two breeds. The results of the study of newly hatched chicks thus indicate that large or small size is dependent upon both the size and the number of cells.

Measurements of the cell lengths in the embryos of eggs which had been incubated 10 days showed that they ranged in about the ratio of 100:75:65 for the large, medium, and small breeds. The ganglion cells were larger in the bantams after 10 days of incubation, but at hatching time there was practically no difference. There was also practically no difference in the size of the nuclear disk of the fresh eggs of the different breeds. The chromosome number was determined for all types at 12, and no significant difference in the size of the chromosomes was observed.



The author concludes that there exists for each developmental stage of a variety a definite specific cell size which, though inherited through several size factors, can be changed by environmental influences such as temperature. A bibliography of 57 references is given, as well as an extensive review of the literature.

**Inheritance of some morphological characters in *Crepis capillaris*,** V. RAU (*Calif. Univ. Pubs. Agr. Sci.*, 2 (1923), No. 7, pp. 217-242, pls. 2, figs. 3).—*C. capillaris* proves to be a valuable species for genetic investigations on account of being a wild plant which has not been subjected to conscious selection by human agency, and for other reasons which are cited. Three quantitative characters studied in this plant were the length of the leaf, the number of lobes in the leaves, and the diameter of the flower heads. The findings are detailed.

**Inheritance of flower color and form in phlox,** J. P. KELLY (*Pennsylvania Sta. Bul.* 181 (1923), p. 14).—A brief account is given of genetical studies of the large-eyed (orbicularis) type of phlox. It was found that plants of this type are monohybrids exhibiting segregation on self-pollination into families that are one-half orbicularis, one-fourth small-eyed, and one-fourth astylis. The latter are characterized by having defective styles. Singleness in flowers was found to be sometimes completely dominant and at other times nearly recessive.

**Genetical research with maize,** E. W. LINDSTROM (*Genetica [The Hague]*, 5 (1923), No. 3-4, pp. 327-356, fig. 1).—This summary of recent genetical work on corn, prepared at Iowa State College, comprises descriptions of the genetic characters of the ear, endosperm, plant, chlorophyll, and anthocyanic or plant colors and their inheritance, and discussion of studies of variegation and mutation, linkage groups of corn, relative frequency of crossing over in microsporogenesis and in megasporogenesis, and effects of inbreeding in corn. The genetic factors in corn are listed alphabetically, and a bibliography is appended.

**Correlation within pure lines of rice,** J. M. CAPINPIN (*Philippine Agr.*, 12 (1923), No. 1, pp. 3-14).—The study of correlations among pure lines within a variety of rice, and among individuals of pure lines in the same variety, led to the conclusion that among plants of a pure strain or those in a state of pure line, culm length may not be taken as an index of a high yielding plant. Tillering, number of bearing culms, and weight of straw were decidedly associated with yield; and length of panicle, number of nodes per panicle, and number of spikes per panicle were slightly associated with yield. The pure lines in a given variety did not show significant figures as to the association of yield and days to maturity. Correlation among varieties showed culm length and yield to be highly and positively associated. In varietal correlation, weight of straw was slightly correlated with yield.

**A recessive black variety of roof rat,** H. W. FELDMAN (*Science*, 58 (1923), No. 1496, p. 163).—A factor for determining black in the roof rat (*Mus alexandrinus*) is described which is recessive to agouti, instead of being dominant to it as occurs with the factor causing black in *M. rattus*.

**Investigations in intersexuality, III,** R. GOLDSCHMIDT (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 31 (1923), No. 1-2, pp. 100-133, figs. 10).—In continuing the studies of intersexuality in the gypsy moth (E. S. R., 50, p. 226), further experiments in crossing  $F_1$  females (from the cross of females of the Ogi strain carrying the strong F factor and males of the Hokkaido strain carrying the weak M factor) with males of the Berlin and Sofia strains showed that by far the greatest proportion of the offspring were females, with strong intersexual tendencies of the few males. Further matings between  $F_1$  females of



strong F strains and weak M strains with males of weak M strains gave similar results.

Further experiments have shown that male intersexuality not only depends on the relation between the factors F and M, but also on the presence of factors T and D, which, when both are in the homozygous dominant condition, determine transformed females, whereas all grades of intersexuality to complete maleness may be determined by different combinations of these two factors.

Four series of experiments were carried out to see if the normal homozygous male behaved differently in breeding experiments from transformed males. The moths were mated in single pairs. In the first test  $F_1$  males from a cross of weak females with strong males were mated with females from a weak race, and in a second experiment similar males were back-crossed with females carrying strong sex factors. By determining the ratio of the sexes of the offspring in the individual crosses, it was shown that they tended to group themselves according to the theoretical ratios for genuine males and for transformed males. There was, however, considerable variation in the sex ratios of individual matings. In the third and fourth experiments similar results were obtained by crossing the  $F_1$  females of the cross strong female  $\times$  weak males with  $F_1$  males from the cross weak females  $\times$  strong males. All of these experiments thus tended to indicate that the genetic constitution of transformed males is really that of females.

Stages in the transformation of ovaries into testicles in the caterpillar have also been observed, which offers further proof of the soundness of the theory of intersexuality.

The results of an experiment in crossing weak and strong races in which practically no normal females were produced indicated that the F factor is always inherited from the mother. A graphical presentation of the theory of intersexuality is given, showing how the quantitative strength or weakness of the M factor determines the normal male or transformed female or the intersexual condition.

**Distribution of sex forms in the phanerogamic flora,** C. and H. YAMPOLSKY (*Leipzig: Borntraeger Bros., 1922, pp. 62*).—In this volume 3 of *Bibliotheca Genetica*, edited by E. Baur, problems of sex in the higher plants are regarded as having great economic significance, notably in connection with the production of seedless fruits. The self-incompatibilities in pears and other food plants are thought to be expressions of grades of strength in one or other sex. In the present study, which was undertaken to ascertain the relative proportions in which such forms occur, Engler and Prantl's *Natürliche Pflanzenfamilien* with the supplements to 1912 was used. The resulting lists of genera and species are confessedly incomplete, and the studies are to be continued.

**Further observations on the inheritance of acquired characters,** R. FICK (*Ztschr. Induktive Abstam. u. Vererbungslehre, 31 (1923), No. 1-2, pp. 134-152*).—This is a discussion of the inheritance of acquired characters, in which the phenomenon of heredity is treated as a chemical reaction.

**The inheritance of seed coat color in certain crosses in grain sorghum,** A. B. CONNER and R. E. KARPER (*Jour. Amer. Soc. Agron., 15 (1923), No. 8, pp. 338-344*).—Natural crosses between Dwarf White milo and Dwarf Yellow milo, Red kafir and White kafir, and Pink kafir and White kafir were grown and studied at the Lubbock, Tex., Substation.

The complete dominance of the Yellow milo seed coat over White milo seed coat color was shown.  $F_1$  of Blackhull White kafir  $\times$  Red kafir have a pale red seed coat, almost exactly intermediate, and a similar condition of intermediacy

is found in  $F_1$  of Blackhull White  $\times$  Pink kafir. Only single factor differences were demonstrated.

The so-called varieties of milo and of kafir seem to differ from one another in seed coat color by a single factor, whereas it has been shown (E. S. R., 38, p. 435; 47, p. 633) that different classes or groups of sorghum, such as feterita and kafir or feterita and Red Amber, differ by two or more factors affecting seed coat color. Moreover, the lack of hybrid vigor in any of the crosses of milo on milo or kafir on kafir would indicate a close relationship between the milos and between the kafirs, especially in growth factors. In all cases observed, crosses between classes or groups of sorghum have shown extraordinary hybrid vigor in the  $F_1$  generation, further indicating that there are more genetic differences between classes or groups than exist between the different forms of milo or kafir.

**Flax pollen and degeneracy in varieties [of flax] cultivated for fiber,** L. BLARINGHEM (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 25, pp. 1603, 1604).—Hybrids of several annual cultivated varieties of flax with *Linum angustifolium* usually proved to be fertile, though possessing pollen partly abortive and seeds variable as to contour and dimensions. All annual varieties cultivated for seed were early, homogeneous, perfect, and uniform as to pollen. The fiber flaxes were mostly heterogeneous. From a Russian flax the author has isolated a strain said to be regular, precocious, and very stable, with perfect and very regular pollen.

## FIELD CROPS.

**Technique of field husbandry experimentation,** T. M. STEVENSON (*Sci. Agr.*, 4 (1923), No. 2, pp. 41-54).—The history and development of agricultural experimental work in Great Britain, United States, and Canada are reviewed briefly, and methods are presented for laying out experimental fields and breeding nurseries, classifying work according to size of unit, check plats and replication, collection of records, and the use of machinery.

**A statistical study of some field plat yields,** R. C. COLLISON and J. D. HARLAN (*New York State Sta. Tech. Bul.* 94 (1923), pp. 5-64, fig. 1).—This comprises three studies noted elsewhere in this issue (pp. 421, 437), and an introduction to these studies, which includes a discussion of methods of interpreting data.

**[Field crops work in Pennsylvania],** C. F. NOLL and J. S. COBB (*Pennsylvania Sta. Bul.* 181 (1923), pp. 7, 8).—Oats and barley continued to lead in the comparison of different spring grains (E. S. R., 49, p. 222). Victory, Crown, and early selections of Japan oats, and Pennsylvania 44 (Fulcaster) and Red Rock wheat were prominent among the varieties. Potato seed studies reported on briefly concerned sun sprouting of cut dormant tubers and the productivity of different eyes.

**Report of the Dominion field husbandman,** E. S. HOPKINS (*Canada Expt. Farms, Div. Field Husb. Rpt.* 1922, pp. 21, figs. 6).—The investigations described comprise cost studies with oats, hay, silage corn, and mangels; comparisons of corn with sunflowers for silage, and of sweet clover with alfalfa, timothy, and mixtures; and rotations. The average yields are tabulated from a rotation of mangels, oats, clover hay, and timothy hay, receiving farm manure and commercial fertilizers alone and in combination.

**Report of the division of forage plants,** G. P. McROSTIE and R. I. HAMILTON (*Canada Expt. Farms, Div. Forage Plants Rpt.* 1922, pp. 42, figs. 4).—Experiments reported on for the year 1922, in continuation of previous work (E. S. R., 48, p. 31), include variety tests of corn and sunflowers for silage, millet, oats, and barley for hay, mangels, swedes, turnips, field carrots, and sugar



beets; comparisons of hay and pasture mixtures; and breeding work with root crops, sunflowers, timothy, western rye grass, orchard grass, meadow fescue, Kentucky blue grass, reedtop, awnless brome grass, alfalfa, and red clover. The dry matter, sugar content, and characteristics are given for each variety of root crops except sugar beets, and representative mangels and field carrots of varieties tested are illustrated.

[Report of field crops work at the St. Kitts-Nevis Experiment Stations, 1920-1922], F. WATTS ET AL. (*West Indies Imp. Dept. Agr., St. Kitts-Nevis Agr. Dept. Rpt., 1920-21, pp. 2-10, 23-27, 29, 30; 1921-22, pp. 3-14, 18-21, 29-34, 35, 41, 42*).—The continuation of earlier experiments (E. S. R., 47, p. 32) is reported.

[Field crops work in Aberdeen, Scotland] (*North of Scot. Col. Agr., Guide Expts. Craibstone, 1923, pp. 9-33, 34-36, fig. 1*).—Investigations with field crops (E. S. R., 48, p. 228) at Craibstone farm near Aberdeen are reported on for 1922.

[Report of field crops work in the Central Provinces and Berar, India, 1921-22], S. T. D. WALLACE, S. G. MUTKEKAR, J. H. RITCHIE, J. C. McDUGALL, R. G. ALLAN, ET AL. (*Cent. Provs. and Berar [India] Dept. Agr., Agr. Stas. South. Circle Rpt. 1922, pp. 1-9; West. Circle Rpt. 1922, pp. 2-18; East. Circle Rpt. 1922, pp. 2-12, 18-23; North. Circle Rpt. 1922, pp. 3, 4, 5, 17-31, 45-47, 58; Expt. Farm., Agr. Col., Nagpur, Rpt. 1922, pp. 3-5, 8-18; Agr. Col., Nagpur, Bot., Chem., and Mycol. Research [etc.] Rpt. 1922, pp. 11-13*).—The continuation of work with field crops along the same general lines as heretofore (E. S. R., 48, p. 629) is reported.

[Report of field crops work in Madras, 1921-22], H. C. SAMPSON (*Madras Dept. Agr. Rpt. 1921-22, pp. 7-12, 14, 16*).—The continuation of work noted earlier (E. S. R., 48, p. 629) is reviewed.

[Field crops experiments in Mysore], L. C. COLEMAN ET AL. (*Mysore Dept. Agr. Rpt. 1921-22 pts. 1, pp. 4-7, 8, 9; 2, pp. 6, 7, 15-24, 26-32, 55-59, 60-62*).—The progress of earlier investigations (E. S. R., 48, p. 434) is reported.

By placing a small piece of wet filter paper within a cell and dusting ragi pollen on the inside of the cover glass, V. K. Badami found that the pollen would germinate within 10 minutes. To get large quantities of ragi pollen, the cut ends of stalks with fresh flowers are placed in water in a stoppered bottle or cylinder in the evening, with the stalks held erect by insertion in holes in a circular card. Between 7 and 9 a. m. the next day the anthers protrude and can be easily removed to watch glasses or dishes. When brought into dry air and light, the sacs soon burst and liberate healthy pollen grains.

The ragi flower is ordinarily self-fertilized, and the minute florets make it almost impossible to prevent self-fertilization and emasculate the flowers. Observations that on a cloudy and rainy day the anthers of ragi flowers hung out intact, and that the pollen was liberated after the dew left and light appeared, led to a method wherein bell jars lined with moist filter paper are placed over the plants in the evening, and the next morning masses of intact anthers are projected.

[Field crops work in Tanganyika], A. H. KIRBY (*Tanganyika Ter. Dept. Agr. Rpt. 1922, pp. 4-14, 15, 16*).—Varietal, seeding, cultural, and improvement tests with cotton, variety tests with tobacco, and trials of various field crops are reported on, with an account of the cotton industry in the colony.

The fertilizing of meadows, P. WAGNER (*Arb. Deut. Landw. Gesell., No. 303 (1921), pp. 141*).—Experiments carried on near Darmstadt during from 4 to 14 years and reported on in summary form were primarily concerned with the questions of yield and composition of hay and the relative needs of nitrogen, potassium, and phosphorus with untreated meadows; and the effects

of nitrogen, potassium, and phosphorus salts alone, in combination, in different forms, and in different times and rates of application on the stands and ratio of grasses and clovers. Other tests had to do with the residual effects of these plant nutrients and with the use of stable manure, compost, sodium chlorid, and lime on meadows.

**Some valuable additions to our useful pasture grasses, J. N. WHITTET** (*Agr. Gaz. N. S. Wales*, 34 (1923), No. 8, pp. 547-551, figs. 3).—Notes on the characteristics and uses of the plants and their adaptation to New South Wales are given for *Panicum antidotale*, Rhodesian buffel grass (*P. maximum*), Kokoma grass (*Rottboellia exaltata*), Kolhapur grass (*Andropogon purpureo-sericeus*) (E. S. R., 46, p. 30), buffel grass (*Pennisetum cenchroides*), false brome grass (*Brachypodium pinnatum*), and slender brome grass (*Bromus marginatus*).

**Outline of general microscopic characteristics of vegetable textile fibers, L. SAVRON** (*Color Trade Jour.*, 12 (1923), No. 5, pp. 224, 225).—The chief microchemical reactions for a number of vegetable fibers and their cross sections when treated with the iodine-sulphuric acid reagent are listed. Some of the reagents especially useful in differentiating the groups include nitric acid containing nitrous oxid gas, aniline sulphate dissolved in water, cochineal in alcohol solution, and phloroglucinol dissolved in water.

**Grading, baling, and inspection of Philippine fibers** (*Philippine Agr. Rev.*, 16 (1923), No. 2, pp. 57-84, 131-153, figs. 2).—Regulations in English and Spanish govern the grading, baling, and inspection of abaca (manila hemp), maguey, sisal, cantala, pacol, and canton fibers. The average tensile strengths of the different grades of abaca, sisal, and maguey fibers are tabulated, with detailed descriptions of the standard grades of abaca fiber.

**The fiber elements of some fiber agaves and Mauritius hemp, V. C. ALDABA** (*Philippine Agr. Rev.*, 16 (1923), No. 2, pp. 120-129, pls. 5).—Methods of preparation and quality of the fiber of *Agave cantala*, *A. sisalana*, *A. fourcroydes*, *A. zapupe*, and *Furcraea gigantea* are described briefly, and from microscopic studies the dimensions and characteristics of the fiber cells are indicated. A key to the identification of the fiber agaves and Mauritius hemp is appended.

**The deterioration of abaca fiber, E. SABLÁN and M. F. VILLARAZA** (*Philippine Agr. Rev.*, 16 (1923), No. 2, p. 100-103).—Measurement of the tensile strengths of the different standard grades of abaca fiber stored for a year, sacked and exposed, demonstrated that the cleaner the fiber is (the less pulp retained) the longer it may be stored with very little deterioration under ordinary conditions. Sacking did not affect deterioration.

**Problems of germinating the various blue grasses, E. H. TOOLE** (*Seed World*, 14 (1923), No. 3, p. 23, 30).—Investigations in progress at the Seed Testing Laboratories, U. S. D. A., are described.

The fundamental requirement for the germination of either Kentucky blue grass or Canada blue grass is to subject the uniformly moistened seed to a daily sharp alternation of temperature of at least 10° C. Six hours at 30° and 18 hours at 20° is probably the best of many possible temperature alternations. Kentucky blue grass will germinate promptly and completely under these conditions, but with most samples of Canada blue grass the temperature alternation should be supplemented by exposure to light, either natural or artificial, for a part of the day and also by moistening the seed with a dilute solution of potassium nitrate. These conditions are fulfilled at the Washington laboratory by germinating Kentucky blue grass on top of blotters, transferring the tests, after about 6 hours in a 30° chamber, into a 20° chamber for the remainder of the 24 hours. Canada blue grass is put in petri dishes on several layers of paper toweling moistened with a 0.2 per cent solution of



potassium nitrate. When it is possible to maintain the room temperature at approximately 20°, the dishes are put in a north window for over night and are transferred to a chamber at 30° for 6 hours during the day.

**Red clover culture**, A. J. PIETERS (*U. S. Dept. Agr., Farmers' Bul. 1339* (1923), pp. 11+33, figs. 21).—This is a revision of Farmers' Bulletin 455 (E. S. R., 25, p. 637). Notes on the insect enemies of red clover, by W. R. Walton, are included.

**Clover seed from southern Europe fails on Indiana farms**, G. I. CHRISTIE (*Indiana Sta. Circ. 114* (1923), pp. 4, figs. 2).—Because of the poor results obtained with clover seed from Italy and other parts of southern Europe, in investigations conducted by the experiment stations of Indiana and adjoining States (E. S. R., 45, p. 532; 47, p. 829), Indiana farmers are urged to determine definitely the source of clover seed before buying.

**Relative adaptability of home grown and foreign grown red clover seed**, R. G. WIGGANS (*Jour. Amer. Soc. Agron., 15* (1923), No. 12, pp. 500-507).—Additional tests (E. S. R., 46, p. 729) at Cornell University, employing red clover seed from Tennessee, Idaho, Michigan, Bohemia, north Germany, Hungary, Chile, Italy, and France, gave striking indications that home grown or native red clover seed produces better yields than foreign grown seed, especially where the winters are severe. Red clover seed grown for several generations under climatic conditions at least as severe as those where the seed are to be sown will probably give best results. If foreign red clover seed must be used in the northern United States, seed produced in continental European countries as far north as possible should be obtained rather than that from seaboard countries.

**Corn breeding**, E. W. LINDSTROM (*Wisconsin Sta. Bul. 356* (1923), pp. 40, figs. 10).—A practical discussion of corn breeding, dealing with pollination, structure and color of the grain, general characters of the seed ear, heredity of grain and ear characters and abnormal plants, earliness, inbreeding, heterosis, show characters, and methods of corn breeding.

For the average corn breeder who does not wish to experiment, field selection of the best ears on the best plants, before harvest when the husks are beginning to show brown, appears to be the most practicable method of maintaining quality and possibly of effecting some improvement. "Improvement of corn by modern genetic methods is too complicated to be practicable for the general farmer, but must be left to the special plant breeder or trained seed grower."

**What makes soft corn in Iowa?** H. A. WALLACE (*Wallaces' Farmer, 48* (1923), No. 40, p. 3).—Seven of the last 33 Iowa corn crops have been characterized by high proportions of soft corn. An analysis of climatic data indicates that, while the softness was apparently caused by frost, the frost in the "soft" years was very little earlier than in other years, and that it was the cold, wet summer weather that allowed the frost to do severe damage. Under Iowa conditions a warm and moderately dry June seems of prime importance in preventing soft corn, and warm weather during August and September with moderately dry weather during May and July are also helpful. So far as the quality of the corn is concerned, cooler weather than usual during November appears of value. The increasing popularity of Reid and similar high yielding types has apparently enlarged the possibility of soft corn damage in Iowa.

**Utilization of Pima cotton**, H. H. WILLIS (*U. S. Dept. Agr. Bul. 1184* (1923), pp. 27, pls. 13, figs. 5).—The extension of the American Egyptian cotton industry is reviewed, the uses and manufacturing qualities of Pima cotton are de-



scribed, and objections current among manufacturers and remedial measures are indicated.

Pima cotton has been used successfully in tire yarns, tire fabrics, and balloon and airplane fabrics (E. S. R., 44, p. 138), where strength and elasticity are the chief requisites, and is being manufactured satisfactorily into fine yarns and shirtings, dimities, lawns, and voiles. The yarns when mercerized are as lustrous as Sakellaridis or Sea Island yarns (E. S. R., 35, p. 137). Pima cotton grown under suitable conditions and properly ginned and well handled is equal to either variety for the manufacture of fine yarns and sheer goods.

The most serious objections offered by the manufacturers of Pima cotton are too great variation in length of staple, poor ginning and rough handling, high percentage of waste, mixed packed bales, too many neps, production on card reduced, and considerable amount of fly. Suggestions made to obtain greater uniformity (E. S. R., 48, p. 229) include field inspection and field segregation; all the cotton in the same bale to be of uniform length and strength, clean, smooth, and well handled and ginned; better methods of ginning and sampling; compressing, preferably at a slow rate; and storage soon after ginning.

**The action of light on cotton**, P. W. CUNLIFFE (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem.*, 2 (1923), No. 19, pp. 244-248).—A summary of the literature.

**Jassid-resistant cottons**, L. WORRALL (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 3, pp. 225-228, figs. 2).—The term "jassid-resistant" refers to the natural hairiness of some of the strains or varieties of American Upland cottons. These hairy types are not wholly immune from injury by a jassid (*Chlorita fascialis*), but so resist this insect that the plant is able to mature its bolls before it becomes injured. Sea Island and Pima-Egyptian were the first species to be injured in studies carried on in Transvaal, while American Upland species were more or less resistant to the attacks.

**The compression of cotton for experimental purposes**, A. M. WILLIAMS (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem.*, 2 (1923), No. 17, pp. 225, 226, fig. 1).—By means of a screw pastille-press, cotton may be compressed into the form of plugs more convenient to handle than loose cotton. Some of the properties of the plugs are described.

**Influencing the quality of flaxseed by means of the time of harvest and rate of seeding**, K. OPITZ and A. VON PANDER (*Faserforschung*, 3 (1923), No. 3, pp. 234-240).—When flax was reaped at green-ripe, yellow-ripe, and dead-ripe stages of maturity, the capsule weight, 1,000-kernel weight, and germinability increased with the progressive ripening of the plant up to the dead-ripe stage, while viability was greatest in seed harvested in the yellow-ripe or intermediate stage. Observations on flax seeded at rates of from 40 to 240 kg. per hectare (35.6 to 213.6 lbs. per acre) showed the number and average weight of capsules to increase with the spacing, i. e., the lightest seedings resulted in stronger plants with more and heavier prolific capsules. Rate of seeding and spacing apparently had no influence on the 1,000-kernel weight, and germinability was only slightly affected. Viability was highest in the produce of light seedings.

**Mauritius hemp (*Furcraea gigantea*), with reference to its inferiority to abaca, maguey, and sisal**, R. B. ESPINO and T. NOVERO (*Philippine Agr. Rev.*, 16 (1923), No. 2, pp. 108-119, pls. 3, fig. 1).—Mauritius hemp is described and the fiber compared with the other fibers named as to yields, reactions to chemicals, tensile strengths, and economic value. Since the fiber of Mauritius hemp is shown to be comparatively weak and the plant is relatively short-lived and a light producer of fiber, while abaca, maguey, sisal, and pineapple plants capable of producing fiber of proved commercial value, already grow



in the Philippines, the culture of Mauritius hemp on an extensive field scale in the islands appears to be impracticable. The possible use of its fiber as an adulterant of abaca also disfavors its culture.

**Standard grades for potatoes**, H. C. MOORE (*Michigan Sta. Quart. Bul.*, 6 (1923), No. 2, pp. 47-50, fig. 1).—The Michigan standard grades for potatoes, effective October 1, 1923, are the same as the United States grades for potatoes (E. S. R., 43, p. 34). Requirements for grades and marking of containers are described briefly.

**Bringing up of new breeds of soy beans in Manchuria** (*Light of Manchuria*, No. 15 (1921), pp. 24-42, figs. 4).—Selection work with soy beans, carried on during six years at the Kungchuling, Manchuria, Experimental Station and reported in some detail, resulted in three stocks of superior quality, each of which was characterized by yields and oil contents about 10 per cent greater than in the original stocks.

**Tobacco investigations at Baldwinsville [N. Y.]**, R. C. COLLISON and J. D. HARLAN (*New York State Sta. Tech. Bul.* 94 (1923), pp. 5, 6, 12-36, 58-60).—A statistical study was made of the crop yields in two tobacco experiments near Baldwinsville, N. Y., conducted in cooperation with the Office of Tobacco Investigations, U. S. D. A.

On Miami gravelly loam in an unmanured rotation of corn, tobacco, wheat, and clover, each one year, tobacco yields were not maintained by commercial fertilizers alone. The practice of using farm manure on tobacco appeared to be favored for the section. On this soil nitrogen seemed to be a limiting factor, while liming greatly increased the tobacco crop. This crop responded to phosphorus and potash to a smaller extent.

On silt loam of the same series, in a rotation of tobacco, wheat, and two years of alfalfa, tobacco production was maintained better, although the production level was considerably lower than on the gravelly loam. With proper and adequate liming this soil grew alfalfa successfully, and alfalfa seemed to fit into the rotation very well. While the response to nitrogen on this soil was not marked, the response to phosphorus and potassium was quite noticeable.

According to the results in the two experiments, the kind of plant indicators used, as well as the soil type, may have a large influence in determining fertilizer response.

**Tobacco experiments**, O. OLSON (*Pennsylvania Sta. Bul.* 181 (1923), p. 11).—Fertilizer tests with tobacco (E. S. R., 49, p. 737) were conducted at Ephrata on a limestone soil and at Lock Haven on a river bottom soil, both with an abundance of manure.

Acre applications of 5 and 10 tons of manure, supplemented with a moderate amount of cottonseed meal, acid phosphate, and potassium sulphate, were shown to increase the yield and improve the quality of tobacco. Application of 1,500 lbs. of cottonseed meal, 300 lbs. of acid phosphate, and 200 lbs. of potassium sulphate gives yields equal to and better leaf than heavy applications of manure alone or supplemented with fertilizer. Potassium sulphate has given a better quality of leaf than potassium chlorid.

Notable among the improved strains are Hibshman Seed Leaf, Ramm Havana, and Olson Seed Leaf.

**Recent Strampelli cereals**, N. STRAMPELLI (*Italia Agr.*, 60 (1923), No. 9, pp. 535-369, pls. 30).—New varieties of wheat developed by the author and described and illustrated in color include Dante, Francesco Strampelli, Carlottina Bianca, Carlottina Rossa, Vittorio Veneto, S. Michele, Gorizia, Trieste, Trento, Fiume, Zara, Cantore, Enrico Toti, Villa Glori, Mentana, Goito, Pelestro, Castelfidardo, Stamura, Italo Giglioli, Fausto Sestini, Attilio Fabrinì,



Cuboni, Marsala, Caprera, Calatafimi, Volturmo, Sapri, Milazzo, Senatore Capelli, and Dauni.

**Preliminary studies on the hard wheats of Morocco**, E. MIÈGE (*Études Préliminaires sur les Blés durs Marocains. Rabat, Morocco: Dir Gén. Agr., Com. et Colon., Serv. Agr., 1922, pp. VIII+128, figs. 37*).—The principal varieties of hard wheat in Morocco are described, illustrated, classified, and compared with varieties from North Africa, and their distribution and agricultural value are indicated. The types known as Zréah, Trikkia, Asker, and Maïzza are considered the most important.

**Varieties of wheat recently grown at Cowra**, J. T. PRIDHAM (*Agr. Gaz. N. S. Wales, 34 (1923), No. 9, pp. 649-654*).—The information, tabulated for 144 varieties of wheat from different parts of the world, is similar to and supplements that noted earlier (E. S. R., 45, p. 42).

**Testing of New Zealand grown wheats**, L. D. FOSTER (*New Zeal. Jour. Agr., 27 (1923), Nos. 1, pp. 1-7; 2, pp. 89-95; 3, pp. 167-174, figs. 4*).—Milling tests of samples of wheat from different localities in New Zealand showed the flour yield of varieties to average as follows: Pearl 73.3 per cent, Velvet 72.4, College Hunters 71.2, Victor 73.7, and Solid-straw Tuscan 72 per cent.

In studies of strength of flour, Velvet was generally conspicuous as the best wheat grown in its district. Burbank Super, Thew, and Huron, although often represented by single samples, gave promise of being wheats of good strength, and John Brown, Dreadnought, Marquis, and Rymer appeared to be good wheats of medium strength. Variety and climate were observed to have a considerable influence on strength.

Judged by loaf volume in baking tests, strong and medium strong New Zealand wheats compared favorably with typical Kansas wheats (E. S. R., 25, p. 860) of the same classes. High protein content was observed to be generally associated with high loaf volume, Burbank Super and Velvet being outstanding in this respect.

**Correlation of wheat kernel plumpness and protein content**, C. H. BAILEY and J. HENDEL (*Jour. Amer. Soc. Agron., 15 (1923), No. 9, pp. 345-350*).—Observations at the Minnesota Experiment Station on samples from the 1911, 1912, 1913, 1921, and 1922 crops of hard spring wheat grown in the Northwest, showed relatively large variations in crude protein (or crude gluten) content and kernel plumpness. No significant correlation was found between wheat kernel plumpness and crude protein (or crude gluten) content when the plumpness was measured in terms of either weight per 1,000 average kernels or weight per bushel.

**The contamination of milling wheat: The effects of strong-scented weed seeds** (*Agr. Gaz. N. S. Wales, 34 (1923), No. 9, p. 628*).—One, 3, 5, and 7 per cent, by count, of seed of Hexham Scent and of sweet clover were allowed to remain for seven days in milling samples of washed wheat in air-tight jars, and were removed by a sieve prior to milling. Bread baked from flour milled from wheat contaminated with 3 and 5 per cent of either seed was satisfactory in texture, flavor, and appearance, but the odors were distinct. It was doubtful whether the characteristic odors could be detected in bread from 1 per cent contaminated wheat.

**Further experiments with contaminated milling wheat** (*Agr. Gaz. N. S. Wales, 34 (1923), No. 12, p. 852*).—After the removal of seed from wheat contaminated as above, 1 per cent by weight of freshly burnt ground lime was mixed with each lot and allowed to remain in air-tight jars for a week. Bread baked from flour milled from these lots after the lime was removed, seemed satisfactory in odor, flavor, and appearance.



**The chief crops of Poland from the standpoint of seed production,** M. B. JANISZOWSKI (*Internatl. Rev. Sci. and Pract. Agr. [Rome], n. ser., 1 (1923), No. 2, pp. 373-378*).—The leading varieties of wheat, rye, barley, oats, potatoes, and forage crops used for seed in Poland are listed, and comment is made on the status of improvement work with these crops and sugar beets.

**Certification of seed grain in Germany in 1922,** W. EDLER (*Mitt. Deut. Landw. Gesell., 38 (1923), No. 37, pp. 488-496, 497, 498, 499*).—The areas of varieties and selections of cereals inspected in 1922, tabulated for the several divisions of Germany, amounted to totals of 31,991.6 hectares (about 79,000 acres) of 55 sorts of winter rye, 745.3 hectares of 4 sorts of spring rye, 20,183.9 hectares of 119 sorts of winter wheat, 4,911.4 hectares of 41 sorts of spring wheat, 3,480.3 hectares of 23 sorts of winter barley, 15,220.6 hectares of 112 sorts of spring barley, and 25,719.5 hectares of 110 sorts of oats.

**How to use the seed laboratory,** O. A. STEVENS (*North Dakota Sta. Circ. 22 (1923), pp. 12, figs. 5*).—The information in this circular concerns sampling, interpreting reports of tests, and the reasons for testing certain agricultural seeds.

**What is a weed?** E. G. CAMPBELL (*Science, 58 (1923), No. 1490, p. 50*).—The following definition is offered: "A weed is an independent plant whose species is persistently obnoxious on cultivation areas."

**The identification of Italian dodders,** G. CAMPANILE and G. B. TRAVERSO (*Staz. Sper. Agr. Ital., 56 (1923), No. 1-3, pp. 5-25, figs. 7*).—The principal species of *Cuscuta* in Italy are described, with notes on their distribution.

**Garlic-scented pennycress, a weed new to Britain,** W. M. WARE and J. E. CHAMBERS (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), No. 6, pp. 535-538, pls. 2*).—Garlic-scented pennycress (*Thlaspi alliaceum*) is recorded as a weed new to Great Britain. It is described, and its origin, harmful properties, and eradication methods are indicated.

***Vicia hirsuta* and its importance as a weed,** LINDEMUTH (*Mitt. Deut. Landw. Gesell., 3 (1923), No. 38, pp. 502-505, figs. 7*).—The distinguishing characteristics of *V. hirsuta* are compared with those of *V. tetrasperma*, *V. cracca*, *V. villosa*, *V. angustifolia*, and *V. sativa*, other important vetches in north Germany. The life history of *V. hirsuta* is detailed, with notes on its dissemination and control.

## HORTICULTURE.

**[Horticultural investigations at the Pennsylvania Station]** (*Pennsylvania Sta. Bul. 181 (1923), pp. 21-24*).—Similarly to that of the preceding year (E. S. R., 49, p. 232), this report consists of brief progress notes.

Of the three tomato varieties Matchum, Penn State Earliana, and Nittany, developed and widely disseminated by the station, the first two are reported by C. E. Myers as having given general satisfaction. As a result of two years' studies of the relation between plat treatment and solidity of head in the Copenhagen cabbage, W. C. Pelton concludes that the water-holding capacity of the soil is an important factor in determining the hardness of the head. Heads were less solid and possessed tenderer flesh and milder flavor at the height of the cutting season than at any other stage. In the case of cabbage, that fertilizer treatment which promoted the largest total yield also gave the largest early yield. However, with the tomato the largest proportion of early fruit, though not the largest total yield, was produced by half-starved plants. In a study of the effect of lime used in connection with various fertilizer treatments, the sulphate of ammonia plats were the only ones to show a consistent response. Lime in the form of pulverized stone apparently had more effect on

total than on early yield, 40 plats showing benefit in early yield as compared with 67 in total yield. A study of 19 soils and soil mixtures as media in which to grow early cabbage plants indicated that a considerable amount of sand in the medium leads to the production of larger roots and smaller tops than when grown in rich soils. Notwithstanding the presence of acidity, applications of lime and acid phosphate to soils rich in organic materials failed to stimulate the growth of seedling cabbages, leading to the conclusion that the plants do not remain in the seed bed long enough for minor unfavorable soil conditions to produce appreciable effects.

As reported by R. D. Anthony, experimental results in Franklin County apple orchards continued to show that trees in sod respond, while trees under cultivation and cover crops fail to show any benefit from nitrogen fertilizers. In one instance 5 lbs. of nitrate of soda per tree, applied two weeks before the flower buds burst, gave as good or better results than did 10 lbs. applied after blooming. In another orchard, trees in sod receiving an application of nitrogen gave as satisfactory results as did similar cultivated trees. A 15-year comparison of legumes and nonlegumes as cover crops for apple orchards showed no difference in favor of either class.

[Horticultural investigations at the Fredericton, N. B. Experimental Station], C. F. BAILEY (*Canada Expt. Farms, Fredericton (N. B.) Sta. Rpt. Supt. 1922, pp. 33-47*).—In a comparison of sprays and dusts for apple tree protection, the larger percentage of perfect fruit was produced by the dusted trees. The removal of hay from a portion of a sod orchard resulted in a marked reduction in yield as compared with that in which the grass was left as a mulch, despite the fact that the entire orchard was treated with nitrate of soda at the rate of 3 lbs. per tree. The results of varietal tests of apples, plums, cherries, and various small fruits and vegetables are presented.

A pruning test with the tomato indicated that two stems per plant results in larger yields than does one stem. The cost of pruning and staking was found prohibitive except when grown on a small scale and for the production of early fruit.

[Horticultural investigations at the Nappan, N. S., Experimental Farm], W. W. BAIRD (*Canada Expt. Farms, Nappan (N. S.) Farm Rpt. Supt. 1922, pp. 32-36, 40-47*).—Seedling No. 12, Jeanne d'Arc, Pearl, and Ste. Antoine de Padua, in the order named, were the most productive strawberries in a test of 42 varieties. In a trial of boards, drainage tiles, and earth for blanching celery, the best results were obtained from the earth. Tiles under 6 in. in diameter were not satisfactory, resulting in decayed leaves. Carrots thinned to 2 in. apart in the row were more productive and of better market quality than those thinned to either 1.5 or 3 in. Results of time of planting tests with garden peas indicated that sowing several varieties of different seasons at one time is a more satisfactory process than that of sowing one variety at different intervals.

**A manual for spraying**, K. L. COCKERHAM (*New York: Macmillan Co., 1923, pp. XI+87, figs. 8*).—A small handbook dealing with spray materials, their preparation, and their application.

**Cover crop problems**, O. M. MORRIS (*Wash. State Hort. Assoc. Proc., 19 (1923), pp. 26-30*).—Fertilizer experiments conducted in a Grandview, Wash., 18-year-old Winesap orchard (trees 30 ft. apart on the square) indicated that nitrogenous materials alone are able to produce significant effects on growth, muriate of potash and superphosphate apparently having no effect. In another Grandview orchard in which alfalfa had been grown for several years, no beneficial effect was noted from nitrogen fertilizers, indicating that where



cover crops are grown fertilizers may have little value. The soil management of orchards is discussed in considerable detail.

**Orchard stand of trees**, W. A. LUCE (*Wash. State Hort. Assoc. Proc.*, 19 (1923), pp. 23-25).—Records taken of the comparative number of spurs and of extra fancy and fancy fruit produced to a height of 12 ft. in the exposed and shaded quarters of apple trees planted 15 by 25 ft., with lines running north and south and east and west, and with the 15-ft. space in the east and west direction, showed a much larger number of spurs and of high-grade fruit on the uncrowded quarters of the tree. To determine the effect of removing some of the crowding trees upon the remainder, records were taken upon the amount and quality of apples produced on trees before and after release. The greatly increased percentage of high-grade apples produced in the zone 0 to 5 ft. elevation following removal of crowding trees was peculiarly significant. Averages estimated from the 1923 crop produced up to 10 ft. height on 9 close planted and 9 released apple trees showed the remarkable value of abundant sunlight in producing first-grade fruit.

**Changes in the respiration rate of ripening apples**, A. M. BURROUGHS (*Amer. Soc. Hort. Sci. Proc.*, 19 (1922), pp. 225-235).—That the time of harvesting has a significant effect on the respiration in apples was shown in an investigation carried on at the Marble Laboratory, Canton, Pa., in the fall of 1922, with fruit gathered at frequent intervals previous to, concurrent with, and after the commercial picking season. Determinations of the rate of carbon dioxid evolution at 68.5° F. showed in all five varieties utilized, namely, Wealthy, Wagener, Baldwin, Northern Spy, and Ben Davis, a marked increase in respiration shortly after removal from the tree. In all Wealthy samples and in the fruit of the other varieties picked during the regular commercial harvest this increase seemed to begin immediately after picking. Immature Baldwins and Wageners held the low initial rate for some time. In the case of Wagener there was a decrease in respiration rate after three or four weeks at 68.5°. The last picked fruits of all varieties except Northern Spy showed a marked increase in the initial rate of CO<sub>2</sub> evolution, and in that the Wagener, Baldwin, and Ben Davis apples were exposed before gathering to a temperature as low as 20° it is believed that this low temperature affected the rate of respiration.

Determinations with Wagener apples picked October 5 and held at 32, 40, 48, and 86° agreed with the findings of Gore (*E. S. R.*, 25, p. 729), namely, that the rate of CO<sub>2</sub> evolution increases according to the temperature coefficient rule, usually known as the van't Hoff's law. Immature fruit held for a short time at 32° prior to placing in 68.5° respired at abnormally high rates in the higher temperature, attaining in some cases a higher rate than fruits gathered at the same time and held continuously at 68.5°. Mature fruits were stimulated less by this low temperature than were immature specimens.

Wageners gathered throughout the season and tested for hardness with the Murneek pressure apparatus (*E. S. R.*, 46, p. 641) showed a reduction of only 0.75 lb. from September 23 to October 13, leading to the deduction that this test is of no practical value for this variety. Other fruits held in the cellar, where the mean temperature was only a little higher than outside, softened more rapidly. Determinations of the dry weight of Wagener apples gathered at successive intervals from September 23 to October 24 showed a general increase during the period. On the other hand, the percentage of fixed acids was found to decrease during the same interval.

**Pruning and fertilizing the D'Anjou pear**, G. G. BROWN and L. CHILDS (*Wash. State Hort. Assoc. Proc.*, 19 (1923), pp. 3-7).—In a comparison of late



summer and early spring pruning on 8-year-old Anjou pears, it was found that pruning at either period reduced growth, as indicated by changes in trunk circumference, the summer pruning being the more limiting. Based on two years' observations, unpruned trees averaged approximately 1 in. larger in circumference than summer pruned and 0.75 in. larger than winter pruned trees. The crop in 1923, following three successive annual prunings, was 2.5 boxes for unpruned trees, 1 box for summer pruned, and 0.75 box for winter pruned trees. In 1922 limbs of certain of the trees lightly pruned in the early spring of 1921 and 1922 were forced down to a horizontal position, with the result that the 1923 crop per tree approximated 1.75 boxes. In that unpruned trees were bushy, thick, and bore their fruit on the outer branches, this system of management is designated as unsatisfactory.

Pruning greatly stimulated fruit production in a 15-year-old, badly crowded Anjou orchard, where low yields obtained despite liberal fertilizing. It is believed that under the crowded conditions prevailing previous to the pruning there had been a reduction of nitrates and an accumulation of carbohydrates in the trees. Pruning, by reducing the carbohydrate reserve, caused the balance between the two materials to become properly adjusted for promoting fruitfulness. Heavily thinned and headed trees averaged 12, while thinned trees averaged but 9 boxes in 1922. In the succeeding year the thinned trees greatly outyielded the thinned and headed trees, leading the authors to suggest that continued heavy pruning can not be successfully practiced without devitalization of the tree. Whereas fertilizers retarded fruiting in younger trees, the older trees required ample fertilization. It is concluded that the Anjou pear requires ample space in the orchard so that sunlight may reach all parts of the tree.

**Notes on the pollination of cherries applied to commercial cherry growing,** C. H. HOOPER (*Jour. Pomol. and Hort. Sci.*, 3 (1924), No. 4, pp. 185-190).—With varieties arranged according to the order of blossoming, information is presented concerning the ability of each to set fruit when self-pollinated, and in most cases satisfactory varieties for interplanting are recommended. Practically all the varieties of cherries tested were found to be self-sterile or so nearly so as to make mixed plantings a necessity. The Wye and ordinary Morellos were found perfectly self-fertile and the Flemish and Kentish Preserving to be self-fertile to some extent. Other varieties, including Turk, Knight Early Black, Victoria Black, Rundles, Amber Bigarreau, and Florence occasionally set some fruit with their own pollen.

**Strawberry varieties for Michigan,** H. D. HOOTMAN (*Michigan Sta. Quart. Bul.*, 6 (1923), No. 2, pp. 45-47).—In a test of 25 strawberry varieties at the Graham Substation, Kellogg Premier not only greatly outyielded other varieties but maintained the size of the berries throughout the entire picking season.

**Cocoa cultivation in the British tropical colonies,** S. H. DAVIES (*Jour. Roy. Soc. Arts*, 72 (1924), No. 3714, pp. 158-168).—This article, originally delivered in the form of two lectures, contains comprehensive information concerning the botany and early history of the cocoa tree, discusses methods of curing and production, and presents statistical data regarding production, exports, imports, etc., of the British colonies.

**Planning rural school grounds,** C. P. HALLIGAN (*Michigan Sta. Quart. Bul.*, 6 (1923), No. 2, pp. 55-60, figs. 2).—A discussion of the general principles involved in the planning and planting of school grounds, supplemented by a list of planting materials adapted for light and heavy soils.



## FORESTRY.

**Silvicultural research and experiment**, C. LEAVITT (*Canad. Forest and Outdoors*, 19 (1923), Nos. 11, pp. 712, 713; 12, pp. 791, 792).—A review of the present status of forestry education and research in the United States and Canada, emphasizing the great need of further advancement in order to place the forests of North America upon a permanent producing basis sufficient to meet the needs of a rapidly growing population.

**Some effects of cover over coniferous seed beds in southern New England**, J. W. TOUMEY and E. J. NEETHLING (*Yale Univ. School Forestry Bul.* 9 (1923), pp. 39, pls. 4, fig. 1).—As a result of detailed studies upon the comparative development of coniferous seedlings grown under uniform soil conditions but submitted to different shading treatments, namely, (1) standard seed box, (2) no protection, and (3) 2.5-in. mulch of partially decayed leaf litter, the authors report that germination was best in the partially closed bed, particularly in the case of small seeded species such as Norway spruce, larch, etc. On the other hand, with large seeded species such as *Pinus canariensis*, *P. palustris*, and *P. pinaster*, the type of cover had little apparent effect on germination. Although germination in the majority of the 11 species studied was earliest in the open bed, the Douglas spruce showed earliest germination in the closed and the Norway spruce in the mulched bed. No correlation was noted between the first and last germination of the various species and the different types of cover. Determinations of moisture in the surface soil layer showed the greatest retention in the mulched bed.

A study of the rate of root penetration for each of the 11 species under the open bed treatment showed an extremely rapid penetration in nearly all cases, for example, the root tip of *P. palustris* attained a depth of 3.25 in. the day following the appearance of the shoot above ground. The larch, Norway spruce, and balsam were slower growing, their roots penetrating to 1 in. at the same stage. Since roots of none of the species were at any time out of moist soil, it is concluded that only under conditions of prolonged drought following germination is there any likelihood of injury to conifers in southern New England and then only to the shallow-rooted species mentioned.

Temperatures recorded at the surface in all three beds showed much higher degrees in the open bed. The high rate of mortality observed in the open bed following hot dry days in late May and early June was found to be largely associated with lesions on the stems of the partially developed seedlings. The lesions are believed to be due to high temperatures occurring under conditions of direct insolation and low humidity. No lesions and comparatively slight mortality were recorded for the covered bed, leading to the conclusion that better survival in coniferous seed beds under partial shade is due largely to lower temperatures. The surviving plants in the open bed were heavier and larger at the end of September than plants similarly exposed in the shaded bed, irrespective of species. In general conclusion, it is emphasized that the heat relation is probably much more important than the water relation in limiting the survival of most coniferous seedlings in the open in southern New England.

**Use of fertilizers in a coniferous nursery**, T. S. HANSEN (*Jour. Forestry*, 21 (1923), No. 7, pp. 732-735, fig. 1).—A study of the effect of 15 fertilizer treatments upon Norway and white pine seedlings sown in prepared beds gave negative results, the control plants being among the best, as indicated by the weight of 100 plants dried to a constant weight. The author believes that coniferous seedlings require very little plant food from the soil, and that even



in light, sandy soil such as used in the test sufficient nutrients are present to produce healthy seedlings over a period of years.

**White pine germination**, A. GRISCH and G. LAKON (*Landw. Jahrb. Schweiz*, 37 (1923), No. 4, pp. 391-407).—In an experiment carried on jointly by the German Seed Testing Station at Hohenheim and the Swiss Agricultural Experiment Station at Oerlikon, it was found that, using the same material at both localities, much higher germinations were secured at the latter station. A study of the situation showed that the success of the Swiss station lay primarily in a method of treatment whereby seeds moistened in spring water were laid away in a cool cellar for 30 days, after which they were brought into a warm chamber with temperature ranging between 22 and 27° C. This treatment of seeds resulted in a very rapid and complete germination. The authors present tabulated results of parallel tests at the Swiss and German stations of the old and new methods of technique, the results showing in almost every case an increase in favor of the new or Swiss method. It is believed that the influence of the cool storage upon moist seeds lies not alone in the intake of water but also in the stimulation of internal chemical changes which favor germination. It is thought that these chemical changes result not only from an increased water content but also from the effect of low temperature.

**The recovery and growth of loblolly pine after suppression**, H. H. CHAPMAN (*Jour. Forestry*, 21 (1923), No. 7, pp. 709-711).—Loblolly pine, forming a varying percentage of the stands of mixed pine and hardwood located on poorly drained alluvial bottoms in the Southeastern States, is greatly stimulated by heavy cutting, fire, or tornadoes which suddenly open up the stand. Records taken on six 143-year-old trees which were released after 63 years of suppression and upon 20 76-year-old trees which were never suppressed showed that the suppressed trees were able after release to attain a maturity and size exceeding that of the normal trees. Since the average diameter of the suppressed trees was but 4.5 in. at the time of release, they had made a subsequent diameter growth nearly equal to that of the normal trees. However, the normal trees in 76 years attained a height of 101 ft., while the suppressed trees reached 103 ft. in 143 years. The rate of diameter growth, on the other hand, jumped to 367 per cent after release. As a practical deduction, the author suggests that greater precautions be taken to preserve small suppressed loblolly pines when lumbering, since these trees are potentially capable of rapid development into merchantable sizes.

**Significance of a 255-year age class in an eastern Kentucky forest**, F. W. HAASIS (*Jour. Forestry*, 21 (1923), No. 7, pp. 700-704).—Observations taken in Letcher County, Ky., in 1915 and 1916 upon the stumps of 198 trees between 241 and 390 years old showed 82 per cent to have been between 241 and 255 years old in 1915, indicating that some catastrophe such as fire had occurred about the year 1660 that destroyed most of the older trees. A study of the growth development by decades of certain of the older trees indicated definite periods of vigorous growth and corresponding periods of slow growth. One of the latter was coincident with the period of the suggested catastrophe, which may have been drought and fires, or insects, fungi, or a period of extended cold, wet weather.

**Logging**, R. C. BRYANT (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1923, 2. ed., rev., pp. XIII+556, pl. 1, figs. 164).—A thoroughly revised and reset edition of a previously noted text (E. S. R., 30, p. 44).

**Selling woodlot products**, J. C. DE CAMP (*Michigan Sta. Quart. Bul.*, 6 (1923), No. 2, pp. 62-64).—The author, pointing out the rapid rise in the value of lumber, especially that of white ash, during recent years, urges more care-



ful management of the woodlot and advises delay in cutting and greater thought in marketing.

**Poisoning green timber**, P. A. HERBERT (*Michigan Sta. Quart. Bul.*, 6 (1923), No. 2, pp. 60, 61).—In an attempt to prevent sprouting, stumps of Carolina poplar 3 to 6 in. in diameter, were wounded by gashes or borings and treated with various poisonous substances, including arsenic trioxid, phosphorus pentoxid, sulphuric acid, phenol, and hydrocyanic acid. None of the trees showed the slightest effect. In duplicated tests with sugar maple, white ash, basswood, beech, American elm, ironwood, jack pine, and Carolina poplar, some small jack pines, to which arsenic was applied in deep gashes at the base, were the only trees to be killed.\* Further experiments showed tentatively that complete girdling will kill stumps. Death, however, is hastened by applying arsenic solution consisting of 1 lb. of arsenic and 1 lb. of washing soda dissolved, after boiling together for one-half hour in a small quantity of water, in 4 gal. of water.

### DISEASES OF PLANTS.

[Report of the department of plant pathology, Pennsylvania Station] (*Pennsylvania Sta. Bul.* 181 (1923), pp. 14-16).—According to investigations conducted by R. C. Walton, it was found that for the control of black rot of apple better results were secured with dust than previously, although not equal to those obtained with commercial lime sulphur. A detailed account of the experiment is to be given in a subsequent publication.

The same author has made a study of the time of infection by apple blotch and found that in the spring of 1922 it started very early, petiole infection being evident on May 23 and fruit infection the first week of June. A similar experiment conducted in the spring of 1923 indicated that infection started later than in the previous years. It is believed that weather conditions are largely responsible for the time of infection by apple blotch. As a result of the investigations it is believed that it is not a safe procedure to start spraying 3 weeks after the petals fall, but that a 2 weeks' or possibly 10 days' application would be more beneficial.

A report is given of studies of diseases of certain truck crops caused by *Sclerotinia* and *Botrytis*, the investigation having been carried on by W. S. Beach. The repetition of experiments with formaldehyde for the control of lettuce drop is said to have given uniformly satisfactory results, and the treatment has proved its value under practical conditions, particularly on the soil in cold frames. With *Sclerotinia* complete control was secured, and with *Botrytis* the control was sufficiently perfect to be profitable, especially with lettuce transplanted from a sterilized seed bed. Rotation has proved of value in reducing the loss caused by *S. libertiana* and *Botrytis* sp. upon lettuce, carrots, and celery under field conditions, but it was less effective against *S. minor*. Bordeaux mixture applied at the rate of 1 gal. to 1 sq. ft. of surface did not prevent the germination of the sclerotia of *S. libertiana*. Tests were made of a large number of other chemicals which failed in varying degrees to kill all the sclerotia of *S. libertiana*.

C. R. Orton and J. P. Kelly report briefly on potato wart, studies of the varietal resistance to which were begun in 1919 (*E. S. R.*, 49, pp. 443, 444). Soil treatments for the eradication of the fungus have not been completed. Several treatments are said to be promising from the point of view of control, but none were economical as regards cost.

A summary is reported by Beach of a previous publication on the crown rot of rhubarb (*E. S. R.*, 48, p. 48), and further investigations on control are



said to show that the setting of disease-free roots in a new location is the most practical measure to recommend at present.

The results of 2 years' work of spraying and dusting for apple scab investigated by H. W. Thurston are said to show the superiority of lime-sulphur or dry lime-sulphur sprays over sulphur dusts for controlling apple scab on the varieties Stayman, McIntosh, Rowe, and Baldwin. The best results with dust were obtained by the use of dusts containing nicotin as well as lime and sulphur. The experiments are said to also emphasize the necessity for timely spraying and the value of a prepink spray for controlling scab in the central part of Pennsylvania.

Beach briefly reports the existence of a bacterial disease of Lima beans as indicated by the failure of copper fungicides to check the disease.

F. D. Kern claims that tests for the control of oat smut indicated that copper carbonate and nickel carbonate give as effective control as the formaldehyde treatment.

**Liquid v. dust spraying**, E. N. CORY (*Peninsula Hort. Soc. [Del.] Trans.*, 35 (1922), pp. 63-67).—Bringing to date and summarizing the extensive available information on dusting as opposed to spraying, the author attempts to show the comparative values of the two methods. Difficulty is found in comparing the data on apple protection owing to differences in composition of the dust used, in time, topography, meteorological conditions, and varieties used in the tests. Taking the results as though truly comparable, it seems that chewing insects are in many instances controlled as well by dusting, but that adequate control of scab by dusting is still very doubtful and that other diseases must still receive a good deal more attention involving increased experience.

Dusting peaches is still in the experimental stage, being often recommended to supplement spraying but never to supplant that method.

**The success of copper**, FONZES-DIACON (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 44 (1923), No. 29, pp. 88, 89).—A brief discussion is given regarding the alleged failure, as fungicides, of sprays lacking copper.

**Specialization in Erysiphe horridula**, S. BLUMER (*Centbl. Bakt. [etc.]*, 2. Abt., 55 (1922), No. 21-24, pp. 480-506, figs. 5).—A study of Erysiphe resulted in the separation of the forms on Boraginaceae from those on the Compositae, and the inclusion of the former under *E. horridula* extended. This form is discussed as to the nature, amount, and assumed causation of the differences. The morphological and the biological differences do not run parallel.

**The biology of Uromyces pisi**, A. BUCHHEIM (*Centbl. Bakt. [etc.]*, 2. Abt., 55 (1922), No. 21-24, pp. 507, 508).—Uredospores of *U. pisi* on *Lathyrus pratensis* infect *Pisum sativum* and *P. arvense*, also *L. nissolia* and *L. articulatus*.

**A study of the environmental conditions influencing the developing of stem rust in the absence of an alternate host.**—II, **Infection studies with Puccinia graminis tritici Form III and Form IX**, G. L. PELTIER (*Nebraska Sta. Research Bul.* 25 (1923), pp. 52, pls. 12).—Following methods previously described (*E. S. R.*, 48, p. 45), the author made a detailed study of two biologic forms of *P. graminis tritici* to determine whether or not their reaction on the differential hosts remained consistent under various environmental factors and at the same time to ascertain the influence of environmental factors on the growth of the differential hosts and on the development of the disease.

The factors controlled in the investigation were soil temperature, soil moisture, and air temperature. In no instance was there found a change in the general type of infection of either biologic form by reason of the environmental factors, nor did the source of the inoculum or the source of the seed of the hosts influence results.



The main types of infection obtained were in agreement with those described by Levine and Stakman (E. S. R., 39, p. 454), although a heterogeneous type of infection was obtained on three varieties of durum wheat.

The best development of the differential hosts at the seedling, stooling, jointing, and heading stages occurred at 15 and 20° C. The optimum temperature for the development of the disease with both forms on plants in the seedling, stooling, and jointing stages was between 20 and 25°. From this it appears that the temperatures at which the plants make their best growth are generally the same as those at which the best development of the disease takes place.

The period of incubation of Form IX was extended over a long period of time (7 to 9 weeks) by submitting inoculated plants to a low temperature. The length of this period is said to depend not only on the temperature but also on the stage of development of the organism in the leaf tissues of the host.

**Smut experiments [Canada],** L. H. NEWMAN (*Canada Expt. Farms, Cereal Div. Rpt. 1922, p. 7*).—The hot water treatment introduced in 1921 was again tested by the same methods, with some additional treatments. The grain was immersed for periods varying from 5 to 15 minutes at 122 to 128° F. The results indicate that the treatment of 15 minutes at 122 to 124° not only lowers the percentage of smut enormously but also gives increased germination.

As to the influence of soil on the proportion of plants attacked, it was found, in confirmation of last year's finding, that a smaller proportion of smutted plants are produced on heavy clay soil than on sandy soil. It appears that the shallower the oats are sown, the smaller will be the proportion of smutted plants. This was in keeping with the results of the previous year. Repeated washings increased the freedom from smut, and washings with 1 per cent of caustic soda further reduced the percentage of smutted plants, though many spores still remained. Early Ripe oats was the variety least subject to smut attacks, Daubeney Ottawa 47 appearing to be the most susceptible.

**Diseases of alfalfa in California,** C. E. SCOTT (*Calif. Dept. Agr. Mo. Bul., 12 (1923), No. 3-4, pp. 151, 152*).—California alfalfa diseases here listed as among the more important include leaf spot (*Pseudopeziza medicaginis*), leaf rust (*Uromyces medicaginis*), root rot (*Sclerotinia trifoliorum*), crown wart (*Urophlyctis alfalfae*, not *Bacterium tumefaciens*), and downy mildew (*Peronospora trifoliorum*).

**The stem nematode of alfalfa in California,** E. H. SMITH (*Calif. Dept. Agr. Mo. Bul., 12 (1923), No. 3-4, pp. 136-138, fig. 1*).—The data here presented, said to be summarized from contributions by McKay (E. S. R., 44, p. 839) and by Smith (E. S. R., 47, p. 751), are given chiefly to supply the information now available on this subject and as an aid in the detection of the attack. This account deals with the symptoms, the organism (*Tylenchus dipsaci*), its history and known distribution, plants affected, transmission, and spread and control of the disease. Recommendations are offered pending further knowledge regarding control measures, including rotation and avoidance of over-irrigation, in particular standing water in any portion of the field.

**Report on black fruit disease of pepper vines in Sarawak,** A. SHARPLES (*Malayan Agr. Jour., 11 (1923), No. 5, pp. 120-128*).—A disease threatening disaster to pepper interests was diagnosed as due to attack by *Cephaleuros mycoidea*, generally a harmless saprophyte found on many plants which are supposed to be injured slightly, if at all, by shading principally due to the fungus.

**Potato diseases and their control,** J. CHAUZIT (*Prog. Agr. et Vitic. (Ed. l'Est-Centre), 44 (1923), Nos. 28, pp. 63-71; 29, pp. 89-95; 30, pp. 115-118; 31,*



pp. 136-141).—A succinct account is given of diseases of the potato plant prevalent in portions of France.

Potato hopperburn (tipburn) control with Bordeaux mixture, T. H. PARKS and E. E. CLAYTON (*Ohio Sta. Bul.* 368 (1923), pp. 243-258, figs. 7).—After briefly describing hopperburn and the relation of potato leafhoppers to the disease, the results are given of two years' work on the control of the disease through the repression of the insects.

Preliminary experiments are said to show that kerosene emulsion did not control the leafhoppers, and that the addition of nicotin to Bordeaux mixture did not give sufficiently greater results to warrant the additional expense. In the progress of the experiments marked differences were noted in the resistance of varieties of potatoes to the disease. Early Triumph was the most susceptible and Irish Cobbler the least damaged among the early varieties. Green Mountain varieties resisted the attack better than the Rural varieties, though spraying gave profitable increases for both types. In 1921, 60 field tests were made in 9 counties with a 5-7.5-50 Bordeaux mixture, and the average increase in yield from these tests was 31.6 bu. per acre, a net gain of \$41.58 for spraying. In 1922, 70 field tests were made in 13 counties, and the average increase in yield for the spraying was 31 bu. per acre, representing a net gain of \$30.28.

Four or five sprayings are considered the most profitable number of applications. Potato dusting mixtures containing dehydrated copper sulphate and nicotin were less efficient in controlling hopperburn than liquid Bordeaux mixture, and the higher cost of the dusting materials reduced the net gain for dusting to \$2.13 per acre.

Leaf roll and mosaic of the potato in Ireland, P. A. MURPHY (*Jour. Natl. Inst. Agr. Bot.*, No. 1 (1922), pp. 47-50).—The probability, appearing in 1921, that an abnormal accumulation of starch in certain of the leaves of plants affected with leaf roll is a constant symptom of this disease, was confirmed in 1922, when it was found to hold, without exception, in the 23 varieties tested. The experimentation is briefly outlined.

It is concluded from results indicated that one of the earliest effects of the leaf roll disease is to interfere with the translocation of carbohydrates from the leaf, and that the rolling of the leaves is a direct consequence of this disturbance. The presence of abnormal quantities of starch in potato leaves is not confined to plants affected with the leaf roll disease, as it is also found sometimes in the upper leaves of stalks which are partially broken across or are injured near the base, in the still green upper leaves of the plants attacked by black stalk rot (*Bacillus atrosepticus*), and in plants which show temporary rolling of the upper leaves due to obscure causes.

The cause of the failure to translocate carbohydrates from rolled leaves can not be ascribed to necrotic phloem, because the appearance of disease in the phloem is subsequent to the first accumulation of starch, and because (assuming that the phloem is the main channel through which carbohydrate translocation takes place) the amount of disorganization found in this tissue does not appear to be sufficient, except perhaps in the most extreme cases of leaf roll, to explain the nonconduction of carbohydrate. Supporting considerations and inferences are given.

In the course of experiments extending over two years and including potato plants of many varieties immune to wart disease which were affected with leaf roll or mosaic or both, no grounds were found for the contention that the presence of these diseases causes a breakdown of immunity to wart disease in such varieties.



**A Verticillium rot of potato tubers**, E. FOEX (*Min. Agr. [France], Ann. Épiphyties*, 9 (1923), No. 2, pp. 121-133, figs. 15).—Potato tubers were found to be attacked near the insertion of the stolon by a species of *Verticillium* showing analogies to *V. alboatrum*.

**Die-back and apple tree rosette**, J. F. ADAMS (*Peninsula Hort. Soc. [Del.] Trans.*, 35 (1922), pp. 68-77).—During 1921 a study was made of a twig blight of Williams apples appearing for some years near Bridgeville, Del. The typical rosette and die-back symptoms are discussed. *Physalospora cydoniae* was found on many of the shoots which had died only after the season's growth was completed.

Lack of soil moisture appears to be the direct predisposing factor, others named as conducive being crown gall, shallow root system, hardpan, and light soil with little humus. Injury due to insects (*Eccoptogaster rugulosus* and *Elaphidion villosum*) associated with affected trees is suggestive of a devitalized condition.

The chief control measures suggested are to maintain a more even moisture supply throughout the growing season, increase the humus content, extend the number of cultivations, and remove diseased wood in fall or early spring.

**Copper injury upon apples**, J. F. ADAMS (*Peninsula Hort. Soc. [Del.] Trans.*, 35 (1922), pp. 32-89, figs. 2).—Apple fruit and leaf injury from Bordeaux mixture, designated by various names, is described, and varieties are classified as to degree of injury from this cause. Recent work indicates no counter-acting effect from the use of excess lime. Reduction of the copper strength in the spray appears to be advisable.

Recommendations include substitution of lime sulphur, the use of a spreader (to prevent undue accumulation), and the addition of sugar (1:16) to prevent the settling out of the copper.

**Some apple diseases not controlled by spraying**, J. F. ADAMS (*Peninsula Hort. Soc. [Del.] Trans.*, 35 (1922), pp. 77-81, fig. 1).—Experience and observations are briefly recounted as relating to certain nonparasitic apple fruit disorders variously designated but mostly characterized by more or less deep-seated spot formation and dryness, presumably referable mainly to lack of balance between water supply and loss. Control measures are preventive and are based on orchard practice as controlling and normalizing conditions of development.

**Cool storage of apples: An investigation of flesh collapse**, R. WATERS (*Ice and Cold Storage [London]*, 25 (1922), No. 295, pp. 241, 242).—A disorder of shipped apples, damaging the interior portions while the exterior remains for a time apparently normal, is reported as the result of a study begun in 1920. A theory advanced in this connection is to the effect that this condition is due to prolonged exposure to low temperature, causing certain physical changes. The effects of temperatures higher than 32° F. have been brought under investigation.

**Brown heart, a functional disease of apples and pears**, F. KIDD and C. WEST ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd. Spec. Rpt.* 12 (1923), pp. IX+54, pls. 19, figs. 17).—The abnormal condition of apples to which it is proposed to give the name brown heart, supposedly identical with that above described by Waters under the name flesh collapse, was first observed by the present authors in the winter of 1918. The conclusion then drawn and since corroborated was that brown heart is liable to appear in storage apples under the concurrent conditions of certain high carbon dioxide and low oxygen concentrations. Recently this observation has become of economic importance, as it has been found possible to diagnose as brown heart an abnormal condition of apples in shipments from Australia and to trace the cause of



serious losses which have occurred to an excess of carbon dioxid combined with a low oxygen concentration in the holds. An account is given in the present report of typical experiments in which brown heart was produced under known conditions as regards temperature, oxygen, and carbon dioxid. Preliminary results are also given of further research, as well as observations on Australian apples shipped and later showing brown heart symptoms, and considerations are presented suggesting that brown heart may be due to essentially the same immediate cause as bitter pit.

Brown heart may occur at any stage in the storage life of the fruit, and the conditions causing it can produce their effect in a short time. Low temperatures increase the susceptibility of the fruit, and varieties and even individual apples differ markedly in this respect.

Attention has been confined chiefly to the concentrations of carbon dioxid and oxygen which are probable in case of fruit under gas-storage conditions, namely, in gas-tight chambers with little or no ventilation. Under these conditions the concentration of carbon dioxid rises, that of oxygen showing a corresponding fall toward zero. The occurrence of brown heart under the influence of carbon dioxid can not be prevented by artificially maintaining a high oxygen concentration.

The danger limit of carbon dioxid differs for different varieties and at different storage temperatures and possibly also for different stages of ripeness and for different concentrations of oxygen. The lowest injurious concentration of carbon dioxid found is 13.6 per cent. It has been shown also that brown heart may be produced by simply exposing the apples to high temperatures (113° F.).

The suggestion is made that bitter pit in the orchard may be due to a temporary excess of carbon dioxid in the internal atmosphere of the apple.

A form of disease, similar to soft or Jonathan scald, has been found to occur under storage conditions characterized by lack of oxygen. This has been described and is termed "deep scald." In common with brown heart and internal breakdown, it appears more readily in apples stored at low temperatures.

Internal breakdown has been briefly described and reasons given for considering its cause to be distinct from that of brown heart. Internal breakdown appears more prevalent in apples stored at low temperatures.

**A new tumor of the apricot**, A. KHAZANOFF (*Jour. Agr. Research* [U. S.], 26 (1923), No. 2, pp. 45-60, pls. 13).—A description is given of a disease of old apricot trees investigated by the author in California in 1916. The gall disease, which is described, is said to be more striking than injurious. It may be readily distinguished from aerial crown gall, with which it is sometimes confused, through the fact that the galls are bark outgrowths in which wood tissue is not mingled, whereas in crown gall the wood is involved in the formation of the tumor. In the case of the gall disease described the galls are said to be thoroughly permeated with gum.

The etiology of the disease was not established with absolute certainty, but a fungus, a species of the genus *Monochaetia*, was isolated that is believed to be the causal agent of the disease. The fungus is said to differ morphologically from the known species of the genus, and it is described under the name *M. rosenwaldia* n. sp.

No young trees were found naturally affected with canker. Control measures based on excision and the application of Bordeaux paste are said to have given satisfactory results.

**Controlling brown rot of peaches**, W. C. TRAVERS (*Peninsula Hort. Soc. [Del.] Trans.*, 35 (1922), pp. 52-54).—Recommendation is made, for the purpose



of brown rot control, of destruction by burning or burial of all diseased fruit, removal of all wood showing cankers, spraying from the period between the bud and the blossom stage to that within two weeks of ripening with self-boiled lime sulphur (8-8-50), except the last spray, for which atomic sulphur is preferred. Arsenicals should be added to control insects.

Dusting, though showing some special advantages, such as superior portability in wet weather, has not proved so generally satisfactory with brown rot or scab as has lime sulphur. The discussion points to a better marketing condition in case of spraying as opposed to dusting.

**H-ion concentration and the development of Sclerotinia apothecia**, W. N. EZEKIEL (*Science*, 58 (1923), No. 1496, p. 166).—Recent experiments are said to have demonstrated a marked relation between the growth of the apothecial stage of the Sclerotinia causing brown rot of stone fruits and the H-ion concentration of the substrate. The experiments showed remarkable acid toleration in developing apothecia, and it seems probable that slight alkalinity of the soil should be sufficient to inhibit their growth.

**Treatments for peach leaf curl in the Rhone Valley**, C. CHABROLIN (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 44 (1923), No. 29, pp. 86, 87).—From tests described it is concluded that peach leaf curl (*Euxoascus deformans*) is absolutely controlled by means of a very alkaline Bordeaux spray applied late in November, also by neutral copper acetates or lime sulphur at the same period, though the last named is markedly injurious if used in February when the trees are more susceptible to the disease. Treatments after March 1 are only partially effective. Treatments at the beginning of winter (November or December) are beneficial also against *Clasterosporium carpophilum*.

**Potassium permanganate for grape Oidium**, L. DEGRULLY (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 44 (1923), No. 28, pp. 56, 57).—Sulphur occasionally failing to control grape Oidium under certain conditions, attention is called to the fungicidal effects of potassium permanganate. This is added (125 gm. in 50 liters of water) to lime (3 kg. to 50 liters of water) and applied with an ordinary sprayer, giving a quick and positive effect.

**Root knot on grape**, R. L. NOUGARET (*Calif. Dept. Agr. Mo. Bul.*, 12 (1923), No. 3-4, pp. 139-150, figs. 4).—Conditions locally favoring infestation with the grape root knot nematode (*Heterodera radicicola*) include soils permitting pronounced seepage and capillary movement, moderate soil temperatures, and moderate irrigation and drainage.

Control must depend mainly upon preventive measures, the most hopeful of which appears to be varietal resistance. Two lots of grapevines (*Riparia* × *Rupestris* 3306 and *Riparia* × *Cordifolia*-*Rupestris* 106-8) showed evidences of root attack by the sugar beet nematode (*H. schachtii*).

**The root knot nematode in relation to deciduous fruit trees and grapevines**, D. G. MILBRATH (*Calif. Dept. Agr. Mo. Bul.*, 12 (1923), No. 3-4, pp. 127-135, figs. 7).—The root knot nematode (*Heterodera radicicola*) as a parasite on the roots of deciduous fruit trees and grapevines has become an important economic factor in the fruit industry of California. This importance has developed, on the one hand, through the increased infestations on the roots of young deciduous fruit trees and grape rootings intended for planting, and, on the other hand, through the frequent injury to trees and grapevines in orchards and vineyards.

The control of the parasite in the orchard and vineyard appears to be a matter of prevention of its introduction and the discovery and propagation of immune rootstocks. Fertilizer and chemical control has not proved efficient, though it appears probable that in some cases the life of the orchard can be slightly prolonged (though without profit) by such means.



**Dichlorohydroquinone as a preventive of spot disease on rubber,** R. O. BISHOP and V. R. GREENSTREET (*Malayan Agr. Jour.*, 11 (1923), No. 5, pp. 129-131).—The results here presented in tabular form show that dichlorohydroquinone is efficacious in preventing the formation of mold in crêpe rubber. An amount equivalent to 35 cc. of a 4 per cent solution to 0.75 gal. of latex containing 15 per cent of rubber is sufficient, when added to the latex direct. This is equivalent approximately to 0.27 per cent of sodium dichlorohydroquinone on the dry rubber or about 6 oz. of the pure chemical per 100 gal. of latex containing 1.5 lbs. of rubber per gallon. By soaking crêpe rubber in the solution, mold growth is not prevented to the same extent, although it may be retarded. The amount of antiseptic necessary to prevent mold growth does not interfere with the normal maturation of slab rubber. These small quantities of the chemical do not appear to affect either the tensile properties or the rate of vulcanization.

**Address to the members of the International Conference of Phytopathology and Economic Entomology,** E. VAN SLOGTEREN (*Haarlem, Netherlands: Nobels Bros.*, 1923, pp. 24, figs. 16).—In this address of the phytopathologist for the bulb district, delivered at Lisse, Netherlands, June 28, 1923, the speaker dealt with the relations to bulbs of *Tylenchus devastatrix* in regard to the transmissibility of the nematodes from one crop to another (biological strains), movements in the soil, and treatment of infected stock (in the field or in a dry state).

Since 1910 a nematode disease of Narcissus has been known locally which was supposed to originate from an adapted strain of nematodes in hyacinths. Tests with cross inoculations involving over 6,000 of each plant failed to develop the disease in any case. From this it is concluded that there is little or no danger at present of infection crossing over between these plants.

As regards movements of the nematodes, it was found that they easily pass through a vertical distance of at least 90 cm. (35.4 in.) in soil.

The pest can live in the soil. It is shown to be necessary, and effective, to remove both the bulbs and soil over an area of from 1 to 2 sq. ft. around an infection. A treatment with water at 43.5° C. (110.3° F.) for from 2.5 to 4 hours kills both the nematodes and Narcissus flies (*Merodon equestris* and *Eumerus strigatus*). The beneficial and injurious effects of this treatment will vary greatly, however, with the duration of the treatment and the development and condition of the bulbs. Damage to bulbs by heat can be remedied and growth promoted by storing in a heated bulb house.

**Observations on a nematode parasitic on cultivated plants,** B. F. RIOFRÍO (*Inst. Gen. y Téc. Valencia, Lab. Hist. Nat. Trab. No. 12* (1922), pp. 11).—A nematode, apparently *Heterodera radicola*, is noted as causing loss locally by attacks on numerous economic plants which are indicated.

## ECONOMIC ZOOLOGY—ENTOMOLOGY.

**A preliminary survey of the bird life of North Dakota,** N. A. WOOD (*Mich. Univ., Mus. Zool. Misc. Pub. 10* (1923), pp. 96, pls. 7).—Three hundred and twenty-one forms are recorded, and a bibliography of 74 titles is appended.

**Studies on the influence of inanition on the development and the duration of life in insects,** S. KOPEĆ (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 46 (1924), No. 1, pp. 1-21).—This is a report of experiments conducted on caterpillars of the gipsy moth at the Government institute for agricultural research at Pulawy, Poland. The paper includes a list of 30 references to the literature.

**H-ion concentrations within the alimentary tract of insects,** W. J. CROZIER (*Jour. Gen. Physiol.*, 6 (1924), No. 3, pp. 289-293, fig. 1).—The author



reports that "larvae of *Psychoda* and of *Chironomus* (Diptera) maintained in solutions of appropriate indicators show that the typical acidities (pH) prevailing within the several regions of the digestive tract are: Esophagus 7.1, cardiac chamber 6.2, mesenteron 7.5, the latter being functionally an intestine. The acidity of the hindgut, pH 6.4, is due to the discharge of the malphigian tubules."

**The inhalation of arsenical insecticide dusts**, [A.] KELSALL and J. H. CAMPBELL (*Sci. Agr.*, 4 (1924), No. 5, pp. 159-161).—This is a report upon determinations made of the actual arsenic which would be inhaled by men engaged in different positions exposed to arsenical dusts. Whether the amounts found may be a menace to health and the precautions which may be adopted as measures of safety are considered.

**The principal parasites of the peach**, W. W. CHASE (*Ga. State Bd. Ent. Bul.* 61 (1922), pp. 43, pls. 12).—This is a revision of *Bulletins* 43 and 57 (E. S. R., 35, p. 447; 43, p. 238), and deals particularly with the peach borer, plum curculio, San José scale, and shot-hole borer and means for their control.

**The possibility of transmitting insects on bud wood with special reference to the avocado**, G. F. MOZNETTE (*Calif. Avocado Assoc. Ann. Rpt.* 1921-1922, pp. 56, 57).—The author calls attention to the possible transmission of insects on bud and grafting wood.

**Papers from the department of forest entomology** (N. Y. State Col. Forestry, Syracuse Univ., Tech. Pub. 16 (1922), pp. 178, pls. 9, figs. 81).—The papers here presented are as follows: An Ecological Study of the Hemiptera of the Cranberry Lake Region, New York, by H. Osborn and C. J. Drake (pp. 5-86); Life History Notes on Cranberry Lake Homoptera, by Osborn (pp. 87-104); Contribution Toward the Life History of *Galeatus peckhami* Ashm. (pp. 105-110), and The Life History of the Birch Tingitid, *Corythucha pallipes* Psly. (pp. 111-116), both by Drake; New Species of Ipidae from Maine (pp. 117-136), Two New Bark Beetles from Colorado (pp. 137-141), and Description of *Hylocurus parkinsoniae* n. sp., with Revisional Notes on *Hylocurus* Eichh. and *Micrais* Lec. (pp. 142-148), all by M. W. Blackman; and The Life History of Two Species of Nabidae (Hemip. Heterop.), *Nabis roseipennis* Reut. and *N. rufusculus* Reut., by F. G. Munding (pp. 149-167).

**Insects affecting livestock**, S. HADWEN (*Canada Dept. Agr. Bul.* 29, n. ser. (1923), pp. 32, figs. 19).—This is a summary of information on the more important insects attacking livestock and means for their control.

**Textbook of medical entomology**, E. MARTINI (*Lehrbuch der Medizinischen Entomologie*. Jena: Gustav Fischer, 1923, pp. XVI+462, figs. 244).—Following an introductory account of the organization and classification of arthropods (pp. 8-71), the subject is dealt with under the headings of arthropods as poisonous animals (pp. 72-94), as parasites (pp. 95-269), and as transmitters of disease (pp. 270-403). The concluding section (pp. 404-429) deals with control measures. Bibliographies accompany the subsections.

**Entomology [at the Pennsylvania Station]** (*Pennsylvania Sta. Bul.* 181 (1923), pp. 16-18).—In reporting briefly upon studies by J. L. Horsfall of the green peach aphid on spinach, it is stated that the average reproductive period in the insectary was 14.8 days, during which time an average of 21.2 young was produced by each female. Nicotin sulphate 40 per cent, at a dilution of 1-500, using soap as a spreader and activator, gave efficient control. Applications of either a 1.25 per cent free nicotin dust or a 2 per cent nicotin sulphate dust were the most satisfactory and economical of any of the several materials applied as dust sprays. The cost of dusting was more than the spraying, although the efficiency was the same at the strengths stated.



Life history studies of the cabbage maggot by Horsfall, continued during 1922, indicate the occurrence of a first and a partial second and third brood in eastern Pennsylvania. Two important parasitic enemies of the maggot, namely, *Baryodma ontarionis* Casey and *Cothonaspis gilletei* Wash., were reared from pupae. Observation showed the last week in April to be the usual time that corrosive sublimate should first be applied. In preliminary work with corrosive sublimate, fields of early cabbages not seriously infested with maggots exhibited as much as 20 per cent earlier heads than their respective checks. No differences were obtained between plats treated with corrosive sublimate 1-1,000 and those receiving a strength of 1-1,600. Costs of treatment, including labor and materials, were from 50 to 80 cts. per each 1,000 plants. Life history studies of the red-banded leaf-roller (*Eulia velutinana* Wlk.) were completed, and similar studies of the four-banded leaf-roller (*E. quadrifasciana* Fern.), a second injurious species, were commenced by S. W. Frost.

Millipedes, which in many sections are largely responsible for the poor stand of lettuce and carrots obtained in fall-seeded cold frames, were controlled by Horsfall by the use of sodium cyanid dissolved in water and applied at the rate of 150 lbs. per acre, sprinkled over the surface of the soil at least 10 days before seeding. Nicotin sulphate in water, 1-500, also furnished control when applied 1 day before seeding. Very favorable results were obtained with a nicotin sulphate dust in a kaolin carrier, at a strength of 2 per cent actual nicotin. Comparative tests, by Frost, of contact dusting materials v. liquid sprays for the control of sucking and chewing insects are briefly referred to.

**Report of the Dominion entomologist for the two years 1919 and 1920**, A. GIBSON (*Canada Dept. Agr., Dominion Ent. Rpt., 1919-1920, pp. 40, figs. 5*).—In this report a general account is given of investigations for the years 1919 and 1920, discussed under the following headings: Insects affecting field and garden crops (pp. 7-16), insects affecting forest and shade trees (pp. 16-19), insects affecting fruit crops (pp. 20-24), insects affecting greenhouse and ornamental plants (p. 24), insects affecting man and domestic animals (pp. 24, 25), insecticides (pp. 25, 26), and the natural control of insects (pp. 26-28). The second part discusses the administration of the regulations under the Destructive Insect and Pest Act (pp. 28-32), the third part the national collection of insects (pp. 32, 33), the fourth part branch laboratories (pp. 33-35), and the fifth part miscellaneous topics, including gopher control by means of chlorin.

**Shot hole borer of tea: Damage caused to the tea bush**, E. R. SPEYER (*Ceylon Dept. Agr. Bul. 60 (1922), pp. 16, pls. 12*).—This is a summary of information on *Xyleborus fornicatus* in Ceylon.

**Orange-tree bug (*Oncoscelis sulciventris*)**, H. TRYON (*Queensland Agr. Jour., 20 (1923), No. 4, pp. 301, 302*).—This is a brief report of control work with *O. sulciventris*, which indicates two methods by which the pest may be successfully controlled.

**The raspberry cane aphid (Hom.)**, P. W. MASON (*Ent. Soc. Wash. Proc., 25 (1923), No. 9, pp. 188-190*).—Under the name *Amphorophora sensoriata*, the author describes a new aphid, commonly known as the cane aphid, which occurs from Massachusetts south to Maryland and west to Kansas and Minnesota.

**Mealybugs on house plants: Life history and control of these troublesome greenhouse and house-plant insects**, E. I. McDANIEL (*Michigan Sta. Quart. Bul., 6 (1923), No. 2, pp. 69-71, figs. 2*).—This is a brief summary of information on the two species of mealybugs which occur commonly indoors in the North, namely, the citrus mealybug and the long-tailed mealybug (*Pseudococcus longispinus* Targ.).



**A preliminary report on paddy fly investigations**, G. D. AUSTIN (*Ceylon Dept. Agr. Bul.* 59 (1922), pp. 22).—This is a report of studies made at Anuradhapura from December, 1920, to June, 1921, of the life history and habits of *Leptocoris varicornis* and means for its control.

**Some preliminary notes on the coconut caterpillar in Ceylon** (*Nephantis serinopa*), J. C. HUTSON (*Ceylon Dept. Agr. Bul.* 58 (1922), pp. 12, pls. 3).—This is a report of studies of a lepidopteran which has been a source of injury to the coconut on areas situated on both the east and west coasts of Ceylon.

**Paradichlorobenzene (p-c-benzene) for controlling the peach tree borer**, A. PETERSON (*New Jersey Stas. Circ.* 156 (1923), pp. 12, figs. 8).—In this revision of Circular 126 (E. S. R., 46, p. 156), it is pointed out that paradichlorobenzene may be used for the control of the peach borer in orchard peach trees 3 years of age or older, but for trees in the nursery or 1 and 2 year-old trees in the orchard the advisability of its unreserved use is still doubtful. Peach borers in greenhouse-grown peach trees 6 years of age or older may be controlled with it. Paradichlorobenzene may be used in the control of peach borers in plum and cherry trees 6 years of age or older, but it is very toxic to apple trees and blackberry bushes, and borers in these plants can not be safely controlled with it.

**A catalogue of the Trinidad Lepidoptera Rhopalocera (butterflies)**, W. J. KAYE (*Trinidad and Tobago Dept. Agr. Mem.* 2 (1921), pp. 163, pl. 1).—This catalogue lists 462 forms.

**The life history of *Chironomus cristatus* Fab. with descriptions of the species**, H. E. BRANCH (*Jour. N. Y. Ent. Soc.*, 31 (1923), No. 1, pp. 15-30, pls. 3).—This is a report of studies of the life cycle of a midge, the larva of which lives in waters charged with milk waste, at Adams Center, N. Y.

**A bacterium pathogenic for common flies: *Bacterium delendae-muscae* n. sp.**, E. ROUBAUD and J. DESCAZEUX (*Compt. Rend. Acad. Sci. [Paris]*, 177 (1923), No. 16, pp. 716, 717).—Under the name *B. delendae-muscae* n. sp., the authors describe a coccobacillus which is apparently the first bacterium known to produce a specific disease in flies. The organism was isolated during the course of a spontaneous outbreak which took place among stable flies being reared experimentally, all of which succumbed within from 2 to 30 days. Other species of flies inoculated succumbed to the disease in from 18 to 24 hours, as did cockroaches and the larvae of *Galleria*. The virulence of the organism was not increased by repeated passage. The disease was reproduced through ingestion, but only in flies (house fly, flesh flies, etc.) and particularly in the larval stage. The adult flies do not appear to contract a fatal disease even when they ingest pure cultures of the organism.

**The life history of *Habronema* in relation to *Musca domestica* and native flies in Queensland**, T. H. JOHNSTON and M. J. BANCROFT (*Roy. Soc. Queensland Proc.*, 32 (1920), pp. 61-88, figs. 7).—"Various flies, both native and introduced, are capable of acting in Queensland as transmitters of one or more of the three species of *Habronema* infesting the stomach of horses. *H. muscae* and *H. megastoma* may be transmitted by the muscids, *Musca domestica*, *M. vetustissima*, *M. fergusonii*, *M. terrae-reginae*, *M. hilli*, and *Pseudopyrellia* (cobalt blue sp.)—also by *Sarcophaga misera*; no doubt by other *Sarcophaga* spp. also. *Anastellorhina augur* can become infected with *Habronema*; probably other blowflies with similar habits could also. They are not, apparently, normal transmitters of the parasites. *H. microstoma* undergoes its larval development in *Stomoxys calcitrans* and not in *M. domestica*. We have not specially tested any of the other flies as possible transmitters of the parasite. *Lyperosia exigua* is suggested as an intermediate host for this species. *Habronema* spp. can make their escape from infected flies into saliva. This



is apparently the normal mode. Thus horses become infected by larvæ escaping from parasitized flies settling on the mouth."

**The effect of food on longevity and reproduction in flies,** R. W. GLASER (*Jour. Expt. Zool.*, 38 (1923), No. 3, pp. 383-412).—The author's experiments with the house fly have been summarized as follows:

"In the summer, house flies reared in captivity without food die in from 1 to 2 days. Reared house flies live only a short while (1 to 8 days) on a diet of proteins or products of protein hydrolysis, and no eggs are laid. Reared house flies live only a short while (2 to 3 days) on a raw starch diet, and no eggs are laid. On a diet of sucrose the longevity of the flies is increased, but no eggs are laid. On a diet of sucrose and distilled water the longevity is approximately the same, and a few eggs are deposited. On a diet of sucrose and bouillon, sucrose and blood serum, glucose and bouillon, and glucose and blood serum the longevity and degree of egg deposition reach their maximum. On a diet of soluble starch and bouillon or hydrated starch and bouillon the longevity of house flies is high, and eggs are deposited." Thus, the experiments led to the conclusion that sugar or some form of starch that can be eaten and assimilated is an important factor in the longevity of adult house flies.

"On the most suitable foods the longevity of *Musca domestica* L. varies from 2 to 57 days, with an arithmetical mean of 20+ days. The longest lived individuals had an arithmetical mean of 34+ days. The preoviposition period of *M. domestica* varies from 11 to 24 days, with an arithmetical mean of 15 days. Female house flies when isolated from males lay fewer eggs than females that have associated with males. As was expected, eggs laid by females in pure female sex lots did not hatch when placed in breeding jars on suitable media. Eggs laid by females in mixed sex lots hatched when placed in breeding jars on suitable media. In general female house flies live longer than males."

Experiments with the stable fly are summarized as follows:

"Reared Stomoxys engorge readily on defibrinated, whole horse or cow blood when the latter is warmed to a temperature of 35 to 37° C. [95 to 98.6° F.]. The longevity of reared Stomoxys fed on defibrinated blood varies from 3 to 46 days, with an arithmetical mean of 20+ days. The longest lived individuals had an arithmetical mean of 35+ days. When fed defibrinated blood, reared Stomoxys in mixed sex lots oviposit from three to seven times and lay many eggs. Reared Stomoxys permitted to engorge daily on a cow (undefibrinated blood) live as long and lay as many eggs as flies fed defibrinated blood.

"Female Stomoxys when isolated from males lay fewer eggs than females that have associated with males. Eggs obtained from mixed sex lots hatch, develop, and produce another generation of flies. Eggs obtained from pure female sex lots do not hatch. The preoviposition period of Stomoxys varies from 9 to 13 days, with an arithmetical mean of 10+ days. Stomoxys will engorge on either the serum or the cellular fraction of the blood. On a diet of serum alone, the longevity is not as high as on a diet of defibrinated blood or when flies under experimental conditions are permitted to feed on cows. No eggs are laid. On a diet of the cellular blood elements the longevity is very low. No eggs are laid. When the two blood fractions are artificially combined again longevity and oviposition become normal."

In experiments with the horn fly (*Lyperosia irritans*), it was found that gravid females removed from cattle and placed in breeding jars lay many eggs, but up to the present this insect can not be reared artificially beyond the first generation of adults since oviposition does not take place in cap-



tivity. " Wild males and females taken from cattle and fed twice daily with defibrinated, warm cow blood remained alive in captivity for from 2 to 25 days, but cease laying eggs in from 3 to 5 days. Experimental evidence is advanced to show that the reproductive organs of the reared and artificially treated females are affected. Observational evidence is advanced to show that the reproductive organs of the reared and artificially treated males are affected. Reared *Lyperosia*, artificially fed, live from 1 to 24 days. The longest lived individuals had an arithmetical mean of 20 days. From two experiments it was possible to show that the preoviposition period of *Lyperosia* probably does not lie far from the thirteenth or seventeenth day after emergence."

A bibliography of 26 titles is included.

**A revision of the Trypetidae of northeastern America**, V. T. PHILLIPS (*Jour. N. Y. Ent. Soc.*, 31 (1923), No. 3, pp. 119-155, pls. 2).—The author presents a key to the genera and species of North American Trypetidae. The genera *Aleomyia* and *Xanthomyia* are erected, and four species are described as new.

**Notes on the biology of the cadelle, *Tenebroides mauritanicus* L.**, R. T. COTTON (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 2, pp. 61-68).—This is a report of detailed studies of the life history and habits of the cadelle at Washington, D. C., much of the data relating to which are presented in tabular form. The author finds that the adults and larvæ of all stages pass the winter in hibernation, and that the overwintering adults lay eggs in the spring which hatch and develop to adults by midsummer. These midsummer adults lay eggs, the larvæ from which overwinter in all stages of maturity, many becoming full grown by fall, but probably none transform until the following spring. The larvæ that overwinter transform in the spring, and the emerging beetles lay eggs all through the summer and hibernate the following winter. It is thought that farther south, in tropical and subtropical climates, development is more or less continuous, and that there may be several generations a year.

**The click beetle (*Pyrophorus luminosus* Ill.)**, G. N. WOLCOTT (*Porto Rico Dept. Agr. and Labor Sta. Circ. 80* (1923), Spanish ed., pp. 8, figs. 3).—A brief account of an elaterid, the larva of which is principally carnivorous and an enemy of white grubs (*Lachnosterna* spp.).

**The destruction of the white grubs or larvae of the cockchafer (*Melolontha vulgaris*)**, H. FAES and M. STAHELIN (*Ann. Agr. Suisse*, 24 (1923), No. 2, pp. 101-105).—The authors' experiments here reported show that the cockchafer is remarkably resistant to contact insecticides. Carbon disulphid clearly affected the cockchafer, but the action of hydrocyanic acid gas and of chloropicrin was much more rapid and complete.

**Cane pest combat and control**, E. JARVIS (*Queensland Agr. Jour.*, 20 (1923), No. 5, pp. 376, 377; also in *La. Planter*, 71 (1923), No. 22, pp. 442, 443, 444).—This is a further report by the entomologist at Meringa, summarizing the results of experiments with paradichlorobenzene for the control of root-eating scarabæid cane grubs (*E. S. R.*, 48, p. 753). Paradichlorobenzene was applied with the Jarvis injector on both sides of cane rows, from 12 to 18 in. apart, 6 in. deep, and 4 in. from stools.

"A fortnight later the odor of the fumigant was noticeable 2 in. below injections and had penetrated upwards to the surface, impregnating a strip of land about 20 in. wide situated directly under the lines of stools. This fumigation of the soil had been accomplished by an evaporation of only  $\frac{1}{4}$  oz. paradichlorobenzene (one-sixth of the 0.25-oz. injection), still leaving sufficient in the soil (5 scruples) to maintain such fumigation for 10 weeks longer. Three months after application the cane was 7 to 8 ft. high, and upon looking down



from a height of about 12 ft. one could at once notice the green edges of treated areas sharply bounded by the yellowing borders of the grub-infested check plats. . . . When examined 3 weeks later (May 17) this contrast between green and yellowing grub-smitten cane had become very marked indeed, and upon counting the stools in 6 treated and the same number of check rows it was found that out of 1,800 treated stools 69 appeared to be grub-affected, while in the 6 untreated rows 1,354 out of 1,800 stools were decidedly grub smitten."

**Two new *Conotrachelus* from tropical fruits** (Coleoptera, Curculionidae), H. S. BARBER (*Ent. Soc. Wash. Proc.*, 25 (1923), No. 9, pp. 182-185, figs. 1).—*C. aguacatae*, infesting young avocado fruit at Huascata, Jalisco, Mex., and *C. sapotae*, the larvae of which were found tunneling through the flesh of *Achras sapota* in Habana Province, Cuba, are described as new. *C. aguacatae* was observed in May, 1923, to have destroyed a large percentage of the crop of avocado at Huascata, which was lying on the ground.

**Observations on the bionomics of the apple blossom weevil, *Anthonomus pomorum* L.**, H. W. MILES (*Ann. Appl. Biol.*, 10 (1923), No. 3-4, pp. 348-369, pls. 2, figs. 11).—"The life history of the apple blossom weevil, *A. pomorum*, a serious pest in apple-growing districts, has been worked out and is herein described. The adult, of which a full description including that of the alimentary and genital systems is given, spends the winter hibernating in or near apple orchards. In spring the adults leave their winter quarters and, prior to mating, feed by piercing the fruit buds and sucking the juices. Egg laying is performed when the development of the buds is in the stage known as 'cluster-bud.' The egg is thrust into the center of the young flower by the ovipositor of the female. The stages oval, larval, and pupal are described, followed by a discussion of the habits of the young adult, which is shown to feed on the undersurfaces of the leaves. Natural enemies, including birds, insects, and fungi, are shown to play an important part in limiting the extent and distribution of the weevil."

**Results of cotton dusting experiments for 1921 together with summary of dusting results for past three years**, D. C. WARREN (*Ga. State Bd. Ent. Bul.* 62 (1922), pp. [13]).—This is a report upon dusting experiments for control of the boll weevil in continuation of that of the preceding year (*E. S. R.*, 46, p. 58), and carried on at Valdosta, Thomasville, and Baxley.

The increased yields from dusting at all the stations were much smaller than the preceding year. This is attributed to the very dry, hot weather throughout the month of June, during which time a very small percentage of weevils hatched from infested squares, the checks or undusted blocks thus being protected by a natural control. A summary of the three years' work shows the gain in seed cotton from dusting short staple cotton to have been 206 lbs. per acre and Sea Island cotton 159 lbs. It is pointed out that since on an average 100 lbs. of seed cotton should pay for the expense of poisoning a considerable gain resulted. Recommendations for Dusting Recommended by the Board for the Year 1922 (pp. 12, 13) are presented by I. W. Williams.

**Habits and activities of bees**, F. JAGER (*Minn. Agr. Ext. Spec. Bul.* 73 (1923), pp. 20, figs. 14).—A popular summary of information.

**The imported pine sawfly**, W. MIDDLETON (*U. S. Dept. Agr. Bul.* 1182 (1923), pp. 22, figs. 8).—This bulletin contains descriptions of the principal stages of *Diprion simile* Htg. and gives information on its life history, host plants, distribution, and importance, together with a brief discussion of its control. The account is based upon investigations conducted at the eastern field station of the U. S. D. A. Bureau of Entomology, at East Falls Church, Va., from August, 1915, to the spring of 1919. The species, which now occurs in Con-



necticut, New York, Pennsylvania, and New Jersey and has been received from Massachusetts and recorded from Indiana, appears to have been introduced from Europe with imported nursery stock. Studies of this pest by Britten and Zappe at the Connecticut Station have been noted (E. S. R., 39, p. 760).

*Prospaltella berlesei* How., parasite of *Diaspis pentagona* Targ., J. DE CAMPOS NOVAES (Bol. Agr. [Sao Paulo], 23. ser., No. 11-12 (1922), pp. 343-366, figs. 22).—This is an account of a parasite of the mulberry scale, *P. berlesei*, with detailed technical descriptions of the host and parasite.

The biology of *Schizaspidia tenuicornis* Ashm., a eucharid parasite of *Camponotus*, C. P. CLAUSEN (Ann. Ent. Soc. Amer., 16 (1923), No. 3, pp. 195-219, figs. 15).—This is an account of the life history of a parasite of the large *C. herculeanus japonicus* Mayr. at Koiwai, Iwate-ken, Japan. The eggs of this parasite are placed en mass within the buds of various trees, where they pass the winter. The larvae upon hatching out in July from dead buds attach to visiting ants and are carried to the nests.

### FOODS—HUMAN NUTRITION.

**Flat sours, I, II** (Michigan Sta. Tech. Bul. 59 (1923), pp. 29).—This investigation of the cause of the so-called flat sours in canned foods is reported in two parts as follows:

I. *An interesting thermophile encountered in canned string beans*, Z. N. Wyant (pp. 3-10).—This deals with the cultural and morphological properties of an anaerobic thermophile isolated from several cans of a single pack of long-processed, cold-packed string beans. All of the cans in this pack (quart Mason jars) contained more or less of a white sediment and showed no signs of leakage or swell. When opened the beans were found to be decidedly sour (pH 4.4) and to have a putrefactive odor which gradually disappeared on standing, but became intensified on heating. The liquor from the beans was not toxic for guinea pigs.

The thermophile is described as a straight rod growing in pairs and short chains with terminal or subterminal spores. The minimum and optimum temperatures for its growth in suitable media are from 40 to 50° and from 55 to 65° C., respectively, while it is not killed by temperatures as high as 70°. It is an active gas former. It grows anaerobically in many media, forming gas with a peculiar odor. Its most striking characteristic is the low visibility of the colonies on agar media. This is thought to be due to a similar refractibility of the organism and media.

"Since thermophiles are not infrequently found in canned foods and because of the discovery of this peculiarly growing anaerobic thermophile, it seems desirable (1) that the microbiologists in food research laboratories should make a practice of culturing all spoiled foods, canned or otherwise, both aerobically and anaerobically not only at room and body temperatures but also at a temperature sufficiently high to demonstrate the possible presence of thermophiles; (2) it seems that attention should be directed to the improvement of technique designed to overcome the difficulty of demonstrating organisms of low visibility of the type described or ultramicroscopic organisms."

II. *Bacteriological studies of flat sours of cold-packed canned peas*, Z. N. Wyant and R. L. Tweed (pp. 11-29).—In the systematic study of flat sours in canned peas, a pea agar simulating as closely as possible the composition of canned peas was used for anaerobic and aerobic culture at 20, 37, and 55° C. Two of the cans proved to be sterile. Plates from the third contained acid colonies in 24 hours at 37 and 55° and in 48 hours at 20° both in aerobic and

anaerobic culture. On transferring typical colonies to pea agar shakes and reculturing at the different temperatures employed, two general types of colonies were isolated, one concentrically ringed and the other smooth and round. From these colonies 7 representative pure cultures were examined for morphology, cultural characteristics, and physical and biochemical features. Of particular interest in connection with canning problems are the observations that all grew well at 20°, but that the optimum temperature for growth was from 37 to 55°, and that when grown anaerobically at varying temperatures the rise in acidity was as rapid or even more rapid at 20° than at 55°, indicating that souring caused by these organisms would develop at room temperature as readily as at higher temperatures.

These results were confirmed by inoculation of sterile cans of different vegetables and incubation for a considerable period of time. The jars whose contents had pH values below 5.8 were flat sours, and with all the organisms tested the greatest number of flat sours was produced at 20°. The practical conclusions drawn are that "flat sours may develop (1) when blanched products are allowed to stand, (2) when cans are not cooled quickly after processing, and (3) when storage temperature is too high. In both of the latter cases the assumption is that the product is not sterile. From a scientific standpoint it would be well to sterilize all canned goods, but from a practical standpoint this may not be advisable. All cans, however, should be cooled rapidly after being processed and stored at a low temperature."

**Indexes of nutrition**, T. CLARK, E. SYDENSTRICKER, and S. D. COLLINS (*Pub. Health Rpts. [U. S.]*, 38 (1923), No. 23, pp. 1239-1270).—For the purpose of comparing the different standards at present employed to classify the nutritional condition of children, three of the more common standards now in use, the Wood standard (height, weight, age tables), the Dreyer standard of stem length and chest circumference (*E. S. R.*, 47, p. 164), and the Pirquet "pelidisi" standard (*E. S. R.*, 48, p. 462) have been applied to a selected group of 506 white children. These children were of native parentage and native grandparents, had no physical defects, and were in a good or excellent nutritional state according to certain definite clinical evidence.

On application of the various standards, it was found that 20 per cent of the children were more than 10 per cent underweight according to the Wood standard, 13 per cent according to the Dreyer standard, and 17 per cent according to the Pirquet standard. Of the entire number of 506, 210 were classed as underweight by one or more of the three standards, while of this number only 15 were classified as underweight by all three standards. Moreover, several individuals classed as underweight by one standard were classed as overweight by one or both of the other standards.

**Indexes of nutrition** (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 15, pp. 1286, 1287).—In this editorial comment on the above investigation, the conclusion is drawn that instead of applying too rigorously the present standards of nutritional condition "we should await more information, as one report insists, to place both corrective work for malnutrition and general procedures in health education on a more secure scientific basis. However, a mediocre average—the mere attainment of a uniform 'standard' of excellence—should not be the goal of American public health effort."

**Basal metabolism and the menstrual cycle**, G. WAKEHAM (*Jour. Biol. Chem.*, 56 (1923), No. 2, pp. 555-567, figs. 4).—The results of 98 basal metabolism determinations on 24 young women subjects immediately before, during, and after their menstrual periods are reported in tabular form, including the normal basal metabolism as calculated from the tables of Sanborn, and the percentage above or below normal of each of the determinations. The



data are further analyzed by plotting these percentage variations from normal horizontally with reference to the first day of the nearest menstrual period and vertically with reference to the normal, a graph being drawn connecting the means of successive 5-day periods. Such of the data of Blunt and Dye (E. S. R., 46, p. 166) as could be oriented with reference to the first day of the menstrual period were plotted in the same way, and in addition data from various individuals in both studies were given the same treatment.

The analysis of the data of the present investigation and also that of Blunt and Dye indicated that there is a distinct fall in basal metabolism during or immediately after menstruation. The data of the present investigation also indicate a premenstrual rise in basal metabolism, but this was not evident in the data of Blunt and Dye. The data are also thought to indicate that basal metabolism is considerably higher on the average in those engaged in strenuous labor than in those of sedentary occupations, and that the variation due to the menstrual cycle is greater in the former than in the latter case. It is also thought that the basal metabolism fluctuations in those living under uniform conditions are less than in those whose mode of life is more varied, and that causes producing too frequent menstruation are likely to be accompanied by high basal metabolism, while those that delay or suppress menstruation are likely to be accompanied by low basal metabolism.

**An oxidative mechanism in the living cell,** F. G. HOPKINS (*Lancet* [London], 1923, I, No. 25, pp. 1251-1254).—In this more popular account of glutathione (E. S. R., 48, p. 311), brief mention is made of a further property of glutathione in its reduced form of hastening the oxidation of unsaturated fats. The explanation advanced for this is that during autoxidation of the sulphur group in glutathione an unstable peroxid is first formed, and the oxygen thus taken up is transferred in whole or in part to the fat. It is noted that the oxidation of the fat by reduced glutathione in the absence of fresh tissue always comes to an end before it is complete, while in the presence of tissue the oxidation may go on to completion. The explanation of this is that, since fat has no power of reducing the —S—S— group of the oxidized form of glutathione to the —SH group of the reduced form, the reaction comes to an end after the —SH group has become completely oxidized, while in the presence of tissue the —SH group as oxidized is being continually reduced by the tissue.

"We see then that the oxidation of a substance involving one type of change (let us say hydrogen transport) may control the oxidation of another substance involving another type of change (oxygen transport). We may recognize here an indication of that correlation and organization of chemical events which is so characteristic of living tissues. The facts adumbrate, or perhaps even indicate, lines on which we can come to understand how in the body the oxidation of fats may depend upon the oxidation of carbohydrates."

**Insulin and glycolysis,** G. S. EADIE, J. J. R. MACLEOD, and E. C. NOBLE (*Amer. Jour. Physiol.*, 65 (1923), No. 3, pp. 462-476).—Insulin was found not to affect the rate of glycolysis in vitro in mixtures of blood or saline and muscle or muscle juice. Glycolysis also proceeded at the same rate in normal blood and in blood removed from animals immediately after injecting insulin or at a later period when hypoglycemia had become pronounced. Insulin was found to have no effect on the rate at which sugar disappeared from sterile pus or on the rate of fermentation of glucose by yeast. These results are thought to indicate that "the more rapid disappearance of glucose in the tissues as a result of insulin injection is dependent upon the integrity of the cell. Restated, then, the problem to be solved is whether insulin acts in the blood—



possibly in conjunction with some circulating coenzym—to form an active ( $\gamma$ ?) form of glucose or a compound of glucose which then passes into the tissue cells (including those of the liver), or whether it passes into the tissue cells before it causes these changes.”

**Biological food tests.**—III, IV (*Amer. Jour. Physiol.*, 65 (1923), No. 3, pp. 491–502, figs. 2; 66 (1923), No. 2, pp. 215–231, figs. 2).—A continuation of the studies previously noted (*E. S. R.*, 50, p. 59).

III. *Changes in vitamins A and B of the globe artichoke due to various canning and drying processes*, A. F. Morgan and H. D. Stephenson.—The globe artichoke (*Cyanara scolymus*) was subjected to proximate analysis and to a study of its content of vitamins A and B as ordinarily cooked and after canning by the cold-pack fractional sterilization and steam-pressure sterilization processes. The edible portion of the artichoke, obtained by boiling the whole heads in water for 1.5 hours, draining, and scraping off the soft part of the leaves and heart and drying the pulp at 70° C., was found to have the following composition: Moisture 6, ash 7.3, protein 12.3, ether extract 2.6, and total carbohydrate 71.8 per cent.

In preparing the vegetable for testing its potency in vitamins A and B, the usual methods of fractional and steam-pressure sterilization were used. In the first process it was estimated that the artichokes were submitted to a possible maximum temperature of 100° for a total of 180 minutes and to varying temperatures between room temperature and 100° for about 6 hours, while in the steam-pressure sterilization the maximum temperature was 121° for 60 minutes, with varying temperatures between this maximum and room temperature for about 2 hours. For the freshly cooked product the vegetables were cooked without added water in glass jars in a boiling water bath for 90 minutes, and for the dried product freshly cooked material was scraped to obtain the edible portion and this was dried rapidly at 70°.

Groups of 4 rats each were fed from weaning on the basal vitamin A-free ration described in the previous study with 4 gm. of the wet edible portion of the two types of canned and of the freshly cooked vegetable as the source of vitamin A. It is reported that the growth curves were steeper than normal in each case. In the case of the freshly cooked product the dose was decreased gradually to determine the least amount sufficient for normal growth. This was found to be 2 gm. of the material, representing 0.3 gm. of dried material. The dried artichoke, when fed in 1 or 0.5 gm. daily amounts, furnished sufficient vitamin A for growth at the normal rate. Smaller amounts were not used.

In testing the same materials for vitamin B, it is reported that growth at nearly the normal rate took place on 4 gm. of the freshly cooked material, but that 2 or 3 gm. proved insufficient. With the two types of canned products, 4 gm. of the edible portion promoted growth at somewhat less than the normal rate, but the animals refused to eat a larger quantity. Of the dried product, doses as large as 2 gm. did not provide sufficient vitamin B for normal growth.

The conclusions drawn by the authors from their observations are that both types of canning decrease the vitamin A value of artichokes about 50 per cent, while the longer fractional sterilization period produces a greater destruction of vitamin B than does the pressure sterilization. This and the greater destruction of vitamin B than of A on drying are thought to indicate that the destruction of vitamin B by canning and drying is relatively rapid, and is more completely brought about by long exposure to relatively low temperatures than by short exposure to higher temperature.

IV. *The protein and the vitamin A content of the English walnut*, H. L. Mignon.—A study was made of the nutritive value of the proteins of the Eng-



lish walnut and of its content in vitamin A, using mice and rats as experimental animals.

In the study of the proteins, hand-blanchd nuts were ground in a meat grinder and the oil removed by pressure in an ordinary hand tincture press and then by extraction with ether in a Soxhlet extractor. The resulting meal was fed to rats and mice as the sole source of protein at 18, 12, and 9 per cent levels in a diet otherwise adequate. A comparison of the growth curves and condition of the animals in the three series indicated a requirement of 12 per cent for uniformly satisfactory nutrition. About the same amounts of the isolated globulin were required as of the mixed protein. The residue left after the extraction of the globulin from the fat-free meal when fed at an 18 per cent level permitted almost normal growth for some time, but eventually produced alimentary disturbances.

The distribution of nitrogen in the walnut globulin, as determined by the Van Slyke method in terms of total nitrogen, is given as follows: Cystin N 0.86, amid N 9.99, humin N 1.84, arginin N 39.13, histidin N 5.74, lysin N 10.61, monamino N 30.36, and nonamino N 0.88 per cent.

The vitamin studies included both curative and protective tests, using the whole walnut, the ether-extracted walnut oil, the residue left from the oil extraction, and the hot alcohol extract of the walnut.

Of the whole meal, 6 gm. daily was required to induce appreciable growth, but normal growth was not obtained even at this level. Of the cold-pressed and ether-extracted oils, 20 per cent did not furnish enough vitamin A for normal growth nor to cure the eye disease or bring the animals back to normal condition. The meal left after the oil had been extracted, when fed in 2 gm. daily amounts, protected the animals to some extent but did not bring them back to normal. One gm. daily was sufficient, however, to prevent or cure ophthalmia, and an equivalent amount of the whole nut (about 3 gm.) also prevented or cured ophthalmia. The extract obtained from the whole nut by hot alcohol contained sufficient vitamin A for normal growth for at least 150 days when it constituted about 20 per cent of the diet as the sole source of both fat and vitamin A.

Several cases of phosphatic renal calculi were noted in the course of the experiment.

**Association of manganese with the so-called vitamins,** J. S. McHARGUE (*Abstr. in Science*, 58 (1923), No. 1497, p. 186).—Attention is called to the apparent correlation between the occurrence of manganese and vitamins [vitamin A?] in animal organs, egg yolk, cod liver oil, and certain fruits. "The author concludes that manganese is closely associated with vitamins and is responsible for the origin of the vitamin factors in some way as yet undetermined, probably catalytically."

**The vitamin content of raisins and raisin by-products,** R. A. DUTCHER and J. outhouse (*Pennsylvania Sta. Bul.* 181 (1923), p. 18).—It is briefly reported that two types of raisins (Thompson Seedless and the large Muscat) do not contain vitamin A or vitamin C in measurable amounts, but that vitamin B is present in both types of raisins and in raisin seeds. Raisin-seed oil showed no vitamin activity.

**Pathogenesis of the ocular lesions produced by a deficiency of vitamin A,** A. M. YUDKIN and R. A. LAMBERT (*Jour. Expt. Med.*, 38 (1923), No. 1, pp. 17-24, pls. 4).—This and the following paper deal with the pathology of vitamin A deficiency as manifested in the ocular lesions known as keratomalacia, xerophthalmia, etc. The investigation reported in the present paper consisted of a detailed histological study of the eyes and adjacent structures of rats in dif-

ferent stages of ophthalmia. Detailed descriptions are given of the findings, together with illustrative plates.

The conclusions drawn from this study are essentially the same as those of an earlier study (E. S. R., 48, p. 863), that the earliest lesions are inflammatory lesions of the conjunctiva of the lid and that the involvement of the cornea is a secondary phenomenon. The fact that both eyes are generally involved simultaneously is thought to suggest the possibility that the condition is a systemic disturbance, which may be due to a deficient production of antibodies or to a diminution of some protective substances in the secretion of the paraocular glands. The rapidity of development of the lesions and the degree of destruction are thought to depend on the type of bacterial infection.

**Changes in the paraocular glands accompanying the ocular lesions which result from a deficiency of vitamin A,** R. A. LAMBERT and A. M. YUDKIN (*Jour. Expt. Med.*, 38 (1923), No. 1, pp. 25-32, pls. 4).—In this histological study of the paraocular glands of rats in various stages of ophthalmia, the findings in the Meibomian, lacrimal, and Harderian glands are considered separately. The Meibomian glands are specialized sebaceous glands which lubricate the margins of the lid. The conjunctival secretion proper is supplied by both the lacrimal and Harderian glands, the secretion of the former being more watery and the latter more fatty in character. In man the Harderian gland is small and of little significance, while in the rat, mouse, and rabbit it is quite prominent.

The histological study of these glands showed questionable changes in the first two, but marked degenerative inflammatory changes in the Harderian glands as the result of a deficiency in vitamin A. "The regenerative changes consist of swelling, vacuolation, and occasionally complete epithelial disintegration. The inflammatory lesions may be either acute or chronic. The acute reactions are sometimes diffuse, but are more often focal. Definite suppuration occasionally results. The acute process generally passes over into a chronic inflammation with mononuclear cell infiltration, fibrosis, and atrophy. The changes demonstrated indicate a serious disturbance in the secretion of the Harderian gland, such as may conceivably render the conjunctiva susceptible to infection."

**The effect of exercise on vitamin requirements,** M. H. KEITH and H. H. MITCHELL (*Amer. Jour. Physiol.*, 65 (1923), No. 1, pp. 128-138, fig. 1).—A comparison is reported of the condition and weight changes of exercised and unexercised rats on rations deficient in vitamin A or B, other conditions being kept as uniform as possible. The rats to be exercised were kept for a certain length of time each day in a cylindrical box made to revolve uniformly around a horizontal axis. The size of the box and the rate of revolution were such that the rats traveled at about the rate of 0.5 mile an hour. The duration of the exercise was gradually brought up to about 6 or 7 hours per day in two periods with rest between and with shorter periods on Saturday and Sunday. Control experiments were run with normal young and full-grown rats on a complete ration to determine whether exercise would in itself affect the weight curves.

In the control experiments consistent results were not obtained, the advantage in some cases appearing to lie with the exercised and in others with the non-exercised rats. Similar results were obtained with the animals on rations lacking in vitamin B, no clear evidence being obtained that the amount and type of muscular work involved produced any effect on the requirement for this vitamin. In the vitamin A experiments, exercise uniformly hastened the appearance of symptoms of vitamin A deficiency and the death of the experimental



animals. It is concluded that vitamin A must be involved in the metabolism incident to increased activity of the voluntary muscles.

**Studies in the physiology of vitamins.—II, Parenteral administration of vitamin B—mammalian experiments,** G. R. COWGILL (*Amer. Jour. Physiol.*, 66 (1923), No. 1, pp. 164–175, figs. 2).—A study is reported of the curative effect for the pathological condition in dogs produced by a deficiency of vitamin B, as noted in the first paper of the series (*E. S. R.*, 46, p. 760), of parenteral injection of a concentrated vitamin B preparation. For this yeast vitamin powder (Harris) was selected as being rich in vitamin B and free from protein. This was dissolved in water, neutralized with litmus, and centrifuged to remove the precipitate.

In two of the three cases in which the preparation was injected into the jugular vein in amounts equivalent to 10 gm. of the powder, relief from severe convulsions resulted in 0.5 hour and 4.25 hours, respectively. The results obtained in the third case were inconclusive, as the animal died 15 minutes after the injection was finished.

Intraperitoneal injections in amounts of 1, 2, and 3 gm., repeated at frequent intervals, resulted in complete recovery on the third day of the experiment. In two other experiments in which 5 and 10 gm., respectively, were injected as a single dose, relief from convulsions was obtained in 3 and 2 hours, respectively, but death followed in about 10 hours.

Subcutaneous injections proved of no value in the case of two animals having convulsions, while in the third, having only moderate symptoms, slow recovery followed.

These results are considered to support the theory that avian polyneuritis and the pathological condition induced in dogs by the absence of vitamin B are of a similar nature, and also to indicate that substances containing vitamin B do not require action upon them by the enzymes contained in the various digestive juices before the vitamin can be effective.

**A study of the vitamin content of Mollusca.—The presence of vitamin C in the oyster,** RANDOIN (*Compt. Rend. Acad. Sci. [Paris]*, 177 (1923), No. 10, pp. 498–501, fig. 1).—The author has tested oysters for the presence of vitamin C by using 15 gm. of the fresh chopped oyster as a supplement to the basal scurvy-producing diet of Lopez-Lomba and Randoïn previously described (*E. S. R.*, 50, p. 166). In the growth curves reported, two guinea pigs on the basal ration alone died of scurvy in from 28 to 33 days, with a loss of from 25 to 35 per cent of their weight. Two others receiving the supplement of oysters maintained their weight and showed no symptoms of scurvy at the end of 45 days, and another gained in weight during this time. It is noted that these experiments were conducted in summer during the spawning season, and that probably in winter under more favorable conditions the use of a smaller quantity of oysters would have given as good results.

**Changes in the weight of the organs of the guinea pig in the course of avitaminosis C,** J. LOPEZ-LOMBA (*Compt. Rend. Acad. Sci. [Paris]*, 176 (1923), No. 24, pp. 1752–1755, fig. 1).—In this study of the progressive changes in the weight of various organs of the guinea pig during experimental scurvy, the time is divided into four periods somewhat as in a similar study of the weight changes in the organs of pigeons on a diet deficient in vitamin B (*E. S. R.*, 50, p. 62).

In the first or incubation period, lasting up to about the sixth day, during which time there were no outward symptoms of scurvy, the thymus and thyroid were found to be atrophied and the spleen and kidneys hypertrophied. In the second period from the sixth to the fifteenth day, during which time the animals were said to be in a state of excitability, the adrenals and spleen showed marked

atrophy and the kidneys and thymus slight atrophy. In the third period, from the fifteenth to the nineteenth day or up to the appearance of hemorrhages, loss in weight, etc., the adrenals, spleen, and kidneys continued to atrophy, while the thymus returned to its original size and the thyroid began to hypertrophy. The liver, which up to this time had shown no change, underwent marked atrophy. The most marked changes in the final period were slight atrophy of the testicles, marked atrophy of the thymus, slight hypertrophy of the liver and thyroid, and marked hypertrophy of the adrenals.

**The action of light on the variations in the calcium content of the serum of rachitic children,** E. LESNÉ, L. DE GENNES, and GUILLAUMIN (*Compt. Rend. Acad. Sci. [Paris]*, 177 (1923), No. 4, pp. 291-294).—Determinations of the calcium content of the blood of 20 rachitic infants examined between March and July showed a content of less than 10 mg. per 100 cc. of serum, while similar determinations made on the blood serum of 2 children aged 3 and 8 years gave values of 11.8 and 11.4 mg., respectively. A lowered calcium content is thus thought to be an index of the active period of rickets rather than the cause of the condition.

On subjecting some of the rachitic infants daily for 30 minutes to artificial light from a 1,200 candlepower arc lamp placed at a distance of 1.2 meters (47.2 in.), the calcium content of the serum increased to normal values in about 3 weeks and remained at this level for about 30 days after the last light treatment. The only exception was in the case of 2 colored children, who showed no change in calcium content and no improvement after 24 treatments. Parallel with the increased content of calcium in the other cases was an improvement in the rachitic condition.

It is also noted that several of the subjects showed signs of spasmophilia, as well as rickets, and that amelioration of this condition also took place following the light treatment.

## ANIMAL PRODUCTION.

**Normal growth of domestic animals,** F. B. MUMFORD ET AL. (*Missouri Sta. Research Bul.* 62 (1923), pp. 3-58, figs. 54).—This publication is the result of the combined study by several investigators at the station of the rate of growth in the different farm animals.

*Growth curves for beef steers,* A. G. Hogan and H. D. Fox (pp. 6, 7).—Growth curves have been constructed for beef steers, based on data furnished by T. L. Haecker, showing the live weights of steers from 1 to 28 months of age. The feeding of these steers was described in Minnesota Station Bulletin 193 (E. S. R., 44, p. 569). The monthly gains in weight give some indication of cyclic growth, which the authors state is not more pronounced since maximum growth was probably not attained.

*Growth of the Hereford-Shorthorn steer,* C. R. Moulton (pp. 8-17).—The monthly live weights, height at withers, length shoulder to ischium, width of hips, and heart girth for the three groups of steers, i. e., full fed, fed for maximum growth without fattening, and fed for poor growth, previously described (E. S. R., 46, p. 66), are presented in tabular and chart form for the ages from birth to 4 years. The curves indicate growth cycles except for height at withers. The maximum rate for live weight is near 10 months, and this is also a high point in the rate of growth of the other parts measured.

*Growth of the dairy cow,* S. Brody and A. C. Ragsdale (pp. 18-25).—This contains essentially the same material as has been previously noted from the studies on the rate of growth of the dairy cow (E. S. R., 49, p. 374), dealing especially with the height-weight curve (E. S. R., 48, p. 274).



*Growth curves of colts*, D. W. Chittenden, E. A. Trowbridge, and Hogan (pp. 26, 27).—The monthly weights of 1 filly from birth to weaning at 6 months and of 4 fillies and 3 geldings from weaning to nearly 2 years of age are given, and growth curves plotted.

*Growth curves of sheep*, Fox, Trowbridge, and Hogan (pp. 28-35).—Curves and tables showing the monthly weights and gains of 14 Shropshire ewes, 10 Hampshire ewes, 8 Shropshire rams, 6 Hampshire rams, and 14 Southdown wethers in the station flock and of 29 Suffolk ewes and 30 Shropshire-Merino ewes from the work of Murray, previously noted (E. S. R., 46, p. 672), are given. The animals have apparently grown in two cycles, the maxima of the first being near birth and of the second at about the seventeenth month for Hampshire and the twelfth month for the other breeds.

*Growth curves of swine*, Mumford, Hogan, and P. M. Bernard (pp. 36-39).—The biweekly weights and gains of the more uniform pigs produced in the early breeding project are tabulated and plotted. The results are based on litter weights up to weaning (8 weeks) and on individual weights from weaning to 30 weeks of age. Weekly weights of 121 hogs from birth to 34 weeks of age are also charted from U. S. D. A. Farmers' Bulletin 874 (E. S. R., 38, p. 169).

*Rate of growth of the domestic fowl*, H. L. Kempster and E. W. Henderson (pp. 40-52).—Based on data from various State experiment stations and from other sources, the weights and rates of gain have been determined for chick embryos and for chickens of the following breeds: White Rocks, White Leghorns, and Rhode Island Reds. Fairly definite cycles of growth were shown for most of the data. The occurrence of maximum growth, however, varied with the different breeds.

*The equivalence of age in some domestic animals*, Brody and Ragsdale (pp. 53-57).—This is a brief account of the paper previously noted (E. S. R., 48, p. 660).

*Progress in animal breeding*, W. TOOLE (*Sci. Agr.*, 3 (1923), No. 10, pp. 341-344).—This is a discussion of livestock breeding in Canada and the United States, emphasizing the need of more rigid selection of animals in our present breeds rather than the development of new breeds to meet special conditions.

*A method of preparing sections of mammalian hair*, J. A. F. ROBERTS (*Jour. Roy. Micros. Soc.*, 1923, No. 2, pp. 198-200, figs. 3).—A method is described for sectioning mammalian hair for microscopic study in genetic, wool, or fur investigations.

*Resistance of pigeons to the lethal action of iletin (insulin), with observed effects on reproduction*, O. RIDDLE (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 5, pp. 244-247).—In experiments carried on at the Carnegie Station for Experimental Evolution, Cold Spring Harbor, N. Y., ovulation was reduced to about 10 per cent of what was expected in 10 pigeons by subcutaneous injections of iletin, a proprietary form of insulin. This lowered the sugar content of the blood to 0.08 per cent (about one-half of normal) for a period not exceeding 4 hours twice daily.

These results tend to substantiate the conclusions previously advanced (E. S. R., 48, p. 273), that a low percentage of blood sugar tends to suppress ovulation. The insulin injections did not suppress ovulation that would occur within 48 hours, but three cases of degenerating ova and two cases in which no ova had been able to pass into the final stage of rapid growth were observed in 5 birds that were killed. A marked resistance to the lethal action of the extract was evidenced in pigeons by giving them doses varying from 1 to 10.5 units. Four fatalities occurred in the 20 birds treated, and impaired vision was also common, though convulsions occurred in but 3 of the 4 birds killed by



the extract. The sugar content of the blood, however, was in some cases reduced to 0.02, 0.03, or 0.04 per cent without death.

**Field corn and silage corn for silage**, C. C. HAYDEN and A. E. PERKINS (*Ohio Sta. Bul.* 369 (1923), pp. 261-288).—This is a detailed report of the investigation briefly described in an earlier paper by the senior author (E. S. R., 50, p. 175).

**The Italian method of ensiling hay**, W. H. PETERSON and L. A. BURKLY (*Hoard's Dairyman*, 66 (1923), No. 4, p. 80).—The authors have experimented at the Wisconsin Experiment Station with the method of ensiling hay as advocated by Samarani (E. S. R., 47, p. 865.) Two experimental silos 4 ft. in diameter and 8 ft. in height were filled with alfalfa containing from 30 to 40 per cent of moisture and sealed. Records of the weights, temperatures, bacterial content, and analyses of the alfalfa and the composition of the gases in the silo were taken at intervals during 100 days.

The composition of the alfalfa remained more nearly the same during the period than has been found to be the case with corn silage. The bacterial content of the alfalfa was also much lower, and there was not the loss of dry matter and production of heat through fermentation that occurs in silage containing more moisture. Alfalfa preserved in this form was also very palatable.

**Effect of autoclaving upon the toxicity of cottonseed meal**, C. T. DOWELL and P. MENAUL (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 1, pp. 9, 10).—Two experiments with small pigs, which were supplied daily with an amount of cottonseed meal equal to 1.33 per cent of their body weight in addition to larso, skim milk, and alfalfa, are reported from the Oklahoma Experiment Station. The cottonseed meal supplied to one lot of pigs in each experiment had been autoclaved at 15 lbs. pressure for 20 minutes and then dried. The average gains of this lot in the first experiment were 33 lbs. in 73 days, and in the second experiment, using a different cottonseed meal, 25 lbs. in 60 days. The corresponding gains of lots receiving the untreated cottonseed meal were 23.5 and 20 lbs., respectively. A control lot receiving tankage in the second experiment in place of the cottonseed meal also gained an average of 25 lbs. per pig. The two pigs receiving the untreated meal in the first experiment died 5 and 10 days, respectively, after the experiment closed, but none of the pigs in the second experiment died even after 90 days' feeding.

No difference between the toxicity of autoclaved and untreated cottonseed meal was evident in two experiments in which sheep were fed for 90 days.

**Quantitative botanical analysis of cattle feeds**, J. A. EZENDAM (*De Kwantitatieve Botanische Analyse van Veevoedermiddelen. Proefschr., Landb. Hoogeschool, Wageningen, 1921*, pp. [4]+84, pls. 6).—This consists mainly of a description of a microscopic method of feed analysis devised by the author, with reviews of other similar methods. The detection of rice, barley, peanut, coffee, cocoa, soy bean, and linseed hulls has been given special attention, and micrographs of some of these products are presented.

**[Sunflower silage v. turnips for fattening steers]**, W. A. MUNRO (*Canada Expt. Farms, Rosthern (Sask.) Sta. Rpt. Supt. 1922*, pp. 7, 8).—To compare sunflower silage and turnips for fattening steers, three lots of 20 steers each averaging about 1,000 lbs. were fed for 166 days on mixed oat and barley meal, oat straw, and hay, and in addition lots 1 and 2 received 20 lbs. (increased to 30 after feeding 1 month) of sunflower silage per 1,000 lbs. of live weight, and lot 3 received turnips at the same rate. During the period of the test the steers receiving sunflower silage made average daily gains of 1.47 and 1.41 lbs., and those receiving turnips 1.39 lbs.

The author concludes from the gains made and the calculated feed costs of gains that sunflower silage and turnips are nearly equal in feeding value



when fed with full grain rations. The silage and roots were stopped 45 days before shipping the steers to Winnipeg, but during shipping they lost an average of 71.6 lbs. each after being fed and watered.

**A report of the committee of inquiry in respect to the cattle industry of Southern Rhodesia, 1923, E. A. NOBBS ET AL.** (*Salisbury, Rhodesia: Govt., 1923, pp. [4]+23*).—This is the report of a committee appointed to investigate the cattle industry in Rhodesia. The more important findings reveal the lack of marketing facilities for beef cattle and the poor quality of the animals produced. It is recommended that efforts be made to find markets and to establish freezing plants in the country, especially in view of the fact that the pastures are only carrying about one-fifth of their capacity.

**[Experiments with sheep at the Agassiz Experimental Farm], W. H. HICKS** (*Canada Expt. Farms, Agassiz (B. C.) Farm Rpt. Supt. 1922, pp. 12-14*).—The report of the sheep investigations includes the results of the following experiments:

*[Birth weights and growth of lambs of different breeding]*.—The average birth weight and daily gains to about 80 days of age made by lambs of different breeding were, respectively, as follows: Second cross Oxford rams on foundation ewes 9.63 and 0.7 lbs., purebred Dorsets 8.07 and 0.686 lbs., Dorset-Oxford crosses 8.65 and 0.682 lbs., and third cross Dorsets 7.68 and 0.673 lbs.

*Breeding ewe lambs v. breeding as shearlings*.—In studying the advisability of breeding ewe lambs as compared with holding them over and breeding them as shearlings. 5 lambs bred in the autumn of 1921 were compared with 5 unbred lambs. The 5 bred lambs averaged 129.8 lbs. on November 1, 1921, and 161.8 lbs. on November 1, 1922, and produced an average of 1 lamb and 8.62 lbs. of wool. The unbred lambs averaged 126.8 lbs. on November 1, 1921, and 177.6 lbs. on November 1, 1922, and produced an average of 10.4 lbs. of wool during 1921.

*Early v. late shearing*.—Ten ewes that had lambed in March or April produced an average of 8.77 lbs. of wool when shorn on May 20, and 4 pregnant ewes shorn in February produced an average of 7.35 lbs. of wool. Three shearlings shorn in February produced an average of 8.6 lbs. of wool, as compared with 10.43 lbs. produced by 15 other shearlings on May 20.

*Wool yields from different groups of sheep*.—The average yields of wool produced by sheep of different breeding were as follows: Shearlings, purebred Dorset 10 lbs., third cross Dorset 10.54, second cross Oxford 11.25 lbs.; and mature ewes, purebred Dorset 7.85, second cross Dorset 8.85, third cross Dorset 11.7, and first cross Oxford 9.98 lbs.

**Cost of feeding lambs, S. BALLANTYNE** (*Canada Expt. Farms, Kapuskasing (Ont.) Sta. Rpt. Supt. 1922, p. 22*).—To determine the cost of feeding lambs, 11 lambs averaging 98.7 lbs. were selected on December 1 and fed a daily ration consisting of 15 lbs. of clover hay, 10 lbs. of oats, peas, and vetch silage, 15 lbs. of pulped roots, and 5.5 lbs. of oats per day. The 11 lambs gained 136 lbs. during the test at a calculated feed cost of 30.6 cts. per pound of gain.

**[Experiments in fattening swine at the Pennsylvania Station], M. F. GRIMES** (*Pennsylvania Sta. Bul. 181 (1923), p. 13*).—Two experiments in comparing different feeds for fattening swine are reported.

*Protein supplements to corn for fattening swine*.—In a comparison of tankage containing 57.5 per cent of protein and 21.8 per cent of ash with tankage containing 49.7 per cent of protein and 27.6 per cent of ash as supplements to shelled corn hand-fed, the lot of pigs receiving the tankage having the higher ash content made slightly greater and more economical gains and the carcasses graded higher.

*By-products for fattening swine.*—Four rations were compared by feeding them to pigs in dry lot for 103 days. In the order in which they produced the highest and most profitable gains, the rations were shelled corn and tankage; shelled corn, blackstrap molasses, and tankage; stale cakes and tankage; and stale bread and tankage. The pigs receiving stale bread refused to eat it after being on a full feed for a short time, and it was found necessary to add some corn to this ration.

[Experiments with swine at the Agassiz Experimental Farm], W. H. Hicks (*Canada Expt. Farms, Agassiz (B. C.) Farm Rpt. Supt. 1922, pp. 15-18*).—The results of the following experiments are reported:

*Breeding experiments with swine.*—A comparison of sows bred at different ages showed that 3 sows which farrowed at 12, 24, and 30 months of age averaged 580 lbs. on December 31, 1922, whereas 3 sows that farrowed at 18, 24, and 30 months of age averaged 450 lbs. at the same time. One sow farrowing at 12 and 18 months of age weighed 475 lbs. at this time.

*Fish meal v. soy bean meal, v. oil cake, v. check.*—To compare the relative value of fish meal, soy bean meal, and oil cake for fattening hogs, 4 lots of 6 pigs each averaging about 60 lbs. were started on a feeding test lasting 11 weeks. Each lot received equal amounts of skim milk and cooked potatoes and in addition a basal grain ration (fed to lot 1 without supplements) consisting of screenings and shorts equal parts. Lots 2, 3, and 4 received protein supplements of fish meal, oil cake meal, or soy bean meal, respectively, in amounts sufficient to make 11 per cent of the grain ration. The average daily gains of the lots per pig were, respectively, 1.52, 1.45, 1.72, and 1.72 lbs. The costs per 100 lbs. of gain were calculated at \$7.48, \$8.73, \$7.64, and \$7.76, respectively. Oil cake and soy bean meal were considered as approximately equal in feeding value, but the fish meal was not relished and was, therefore, unsatisfactory.

*Wintering brood sows in portable cabins in the bush v. brood sows in the piggery.*—Four sows wintered in a piggery with the allowance of a yard during good weather farrowed 47 pigs, of which 29 were raised to 6 weeks of age, at which time they averaged 25.45 lbs. in weight. Four other sows allowed the run of a bush, but sleeping in portable houses, farrowed 39 pigs, of which 29 were raised to 6 weeks of age, at which time they averaged 23.62 lbs. in weight.

*Purebred v. crossbred pigs.*—Four purebred Yorkshire sows bred to a Duroc-Jersey boar farrowed an average of 11.75 pigs, of which 7.75 per sow were raised to 6 weeks of age, at which time they averaged 24.9 lbs. in weight. For a comparison, 3 purebred Yorkshire sows were bred to a Yorkshire boar. They farrowed an average of 10.33 pigs each, of which 8.33 were raised to 6 weeks of age, at which time they averaged 22.88 lbs. in weight. All the pigs were farrowed between March 9 and 25, and on May 15 the crossbreds averaged 41.29 and the purebreds 36.8 lbs. in weight. After weaning, the pigs of both types of breeding were fed in grass paddocks on a ration of screenings, barley, shorts, and skim milk for 119 days. During the first 92 days the crossbreds gained an average of 1.28 lbs. and the purebreds 1.16 lbs. per day, and during the last 27 days they gained 1.24 and 1.17 lbs. in the respective lots. The crossbreds made an estimated average profit per pig over feed cost of \$4.74, as compared with \$3.68 for the purebreds.

*Comparison of clover pasture v. no clover pasture and the self-feeder v. pail feeding [for swine],* S. BALLANTYNE (*Canada Expt. Farms, Kapuskasing (Ont.) Sta. Rpt. Supt. 1922, pp. 23, 24*).—To compare red clover pasture with hand-feeding and self-feeding v. feeding in dry lot, 3 lots of 10 Yorkshire pigs were selected. Lot 1 was hand-fed in dry lot, lot 2 was hand-fed on red



clover pasture, and lot 3 was self-fed on red clover pasture. The lots received the same grain mixtures and equal amounts of skim milk. At the start of the test the pigs averaged about 45 lbs. in live weight, and during 91 days made average daily gains of 0.4, 1.06, and 1.12 lbs. in lots 1, 2, and 3 at calculated feed costs per 100 lbs. of gain of \$14.23, \$8.65, and \$8.89, respectively.

**Cowpeas v. soy beans for pigs** (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 1, pp. 13, 14).—In a comparison of cowpeas and soy beans as forage crops for pigs at the Cedara Department of Agriculture, Union of South Africa, 2 lots of 4 pigs each averaging about 64 lbs. were pastured for 44 days, the one lot on  $\frac{1}{2}$  acre of soy beans and the other lot on  $\frac{1}{2}$  acre of cowpeas. The amount of pasture was limited by a movable fence so that the forage crop was cleaned up before additional pasture was allowed. Each lot received 435 lbs. of corn meal during the test period. The lot on soy beans made average daily gains of 0.69 lb., whereas the lot on cowpeas made average daily gains of 0.49 lb.

**The feeding of animals by the method of equivalent feeds.**—The practical feeding of hogs, A.-M. LEROY (*Rev. Zootech. [Paris]*, 2 (1923), No. 5, pp. 376–385, figs. 4).—The use of a graphical method for hog feeding is suggested which is similar to the one recommended for sheep (*E. S. R.*, 49, p. 269).

**[Poultry experiments at the Agassiz Experimental Farm]**, W. H. HICKS (*Canada Expt. Farms, Agassiz (B. C.) Farm Rpt. Supt. 1922*, pp. 53–57).—The results of poultry experiments are reported as follows:

**Commercial feeds v. home mixture.**—In comparing home mixed and commercial feeds, 1 lot of Barred Rock and 1 of White Leghorn hens received a commercial scratch mixture and a commercial mash and laid an average of 82.5 and 101.3 eggs, respectively, during the year. Similar lots received a home mixed scratch feed of equal parts of wheat and oats and a home mixed mash of 100 parts of bran, 100 parts of shorts, 100 of crushed oats, 100 of corn meal, and 50 parts of soy bean meal and laid averages of 85.8 and 106.5 eggs, respectively, per hen.

**Confinement v. range.**—Two pens of 35 Barred Rocks and 2 pens of 40 White Leghorns were selected for testing range conditions against confinement for laying hens. The confined pen of Barred Rocks laid 5,855 eggs, and the range lot laid 6,270 eggs. The confined White Leghorns laid 7,808 eggs, whereas the White Leghorns on range laid only 7,678. The condition and health of the range pens was the better.

**[Investigations with poultry at the Summerland Experimental Station]**, R. H. HELMER (*Canada Expt. Farms, Summerland (B. C.) Sta. Rpt. Supt. 1922* pp. 85–90).—Results of the following experiments with poultry are briefly reported:

**Egg production.**—*Hens v. pullets by months.*—The monthly records of hens and pullets are given for comparison. The hens averaged 128.41 eggs during the year, as compared with 187.5 eggs for the pullets.

**[Methods of using males].**—In studying different systems of mating, the results of 3 years' experiments show that by the daily alternation of single males between different flocks 75.3 per cent of the eggs produced were fertile, and 52.4 per cent hatched. By alternating pairs of males the fertility was raised to 77.7 per cent and the hatchability to 57.8 per cent. By leaving 1 male in a flock continuously the fertility of the eggs was 74.7 per cent and the hatchability 55 per cent.

**Effect of winter production upon fertility and hatchability.**—Heavy winter production of birds did not appear to affect the hatching percentages of the eggs the following spring. The eggs from hens laying over 100 eggs before March 1 were 76.4 per cent fertile, and 55.9 per cent of the eggs hatched.

When from 76 to 100 and from 50 to 76 eggs were laid before March 1, the fertility was, respectively, 79.1 and 72 per cent and the hatchability 64.1 and 59.7 per cent.

*Incubation and production.*—The average winter egg production of birds hatched on March 17, April 3, April 26, and May 4 was, respectively per bird, 71.5, 69.5, 54.1, and 41.6 eggs.

*[Loss of weight during incubation].*—A study of the loss in weight of eggs during incubation showed that eggs that hatched lost an average of 12.7 per cent from the first to the fifteenth day of incubation. The weights were also taken and reported for the third and seventh days during incubation.

*Fertility and hatchability.*—The egg records, fertility, and hatchability of the first and second years' eggs are given for 33 birds. The author concludes that the eggs of certain birds having high fertility during the first year will be infertile the second year, but ordinarily hens giving good records the first year will continue to do so the second year.

In another test of 18 birds which produced all infertile eggs the previous season, 14 again produced infertile eggs in the spring of 1922. Three of the other 4, however, showed over 92.3 per cent fertility.

*Preservation of eggs.*—Eggs packed in June with different preservatives were tested in March after sealing with commercial preservative grease and packing in cartons the eggs showed evaporation, and the yolks had dropped, but they were quite edible. Eggs packed in water glass were in splendid condition compared with the other treatments, whereas eggs packed in dry dairy salt were unfit for use due to evaporation.

**[Poultry experiments at the Kapuskasing Experimental Station], S. BALLANTYNE** (*Canada Expt. Farms, Kapuskasing (Ont.) Sta. Rpt. Supt. 1922, pp. 83-87*).—The results of the following experiments with poultry are reported:

*Skim milk v. beef scrap.*—To compare skim milk with beef scrap for egg production, 98 Barred Rock pullets were divided into two lots for a test which began November 1, 1921. Both lots received the same feeds except that the mash fed to lot 1 contained 15 per cent beef scrap, whereas lot 2 received skim milk ad libitum. The pullets in lot 1 laid an average of 31.32 eggs and those in lot 2, 42.88 eggs during the six months, November to April. The calculated cost per dozen eggs in the respective lots were 42.19 and 33.65 cts.

*Crate fattening chickens.*—In a study of comparative rations for crate fattening cockerels, 72 cockerels were divided into 6 pens and crate fattened for 21 days. The following rations were fed: Pens 1, 2, 3, and 4, oats, barley, and wheat, equal parts, with skim milk in pens 1 and 3, and 15 per cent of tankage and water in pens 2 and 4; pen 5 oat flour, corn, and middlings, equal parts, and skim milk; and pen 6 oat flour, corn, and middlings, equal parts, with 15 per cent of tankage and water. The average weights of the lots varied from 8 lbs. 5 oz. to 3 lbs. 10 oz. at the start of the test. The average gains during the fattening period were pen 1, 2 lbs. 3.6 oz.; pen 2, 1 lb. 8 oz.; pen 3, 2 lbs. 6.6 oz.; pen 4, 1 lb. 9.3 oz.; pen 5, 2 lbs. 1.6 oz.; and pen 6, 2 lbs. 2.6 oz. The birds consumed an average of 5.2 to 5.3 oz. of feed per day. The calculated profits per bird in the different pens were, respectively, 43.8 cts., 27.66, 49.33, 29.2, 41.5, and 48 cts. above feed cost when the birds were valued at 30 cts. per pound both at the beginning and the end of the test.

**[Poultry experiments at the Rosthern Experimental Station], W. A. MUNRO** (*Canada Expt. Farms, Rosthern (Sask.) Sta. Rpt. Supt. 1922, pp. 53, 54*).—The results of experimental work in poultry are briefly noted as follows:

*Incubation and brooding.*—A comparison of the hatching results in three different makes of incubators showed that 31 per cent of the eggs hatched in the



Buckeye, 24.5 per cent in the Cyphers, and 39.2 per cent in the Tamlin. The eggs set in the Buckeye were 94 per cent fertile, those in the Cyphers 77 per cent, and those in the Tamlin 73 per cent fertile.

*Hatching from hens v. pullets.*—A comparison of the hatching results with eggs from hens and pullets showed that 87.5 per cent of the hens' eggs were fertile and 69.5 per cent of the pullets' eggs. In the case of the hens' eggs 50 per cent of the fertile eggs hatched, whereas only 27.6 per cent of the fertile pullets' eggs hatched.

[*Cost of rearing ducks*].—The cost of rearing 35 ducks hatched on June 12, weighing a total of 2.9 lbs., to 8 weeks of age, at which time they weighed 115.9 lbs., was \$3.60. In making this growth 388.5 lbs. of mash and 564.75 lbs. of milk were consumed.

The effect of the antineuritic vitamin (accessory food factor B) on the egg production and condition of laying hens, A. J. SOUBA, H. C. KNANDEL, and R. A. DUTCHER (*Pennsylvania Sta. Bul.* 181 (1923), p. 26).—Feeding a commercial yeast product containing corn meal to White Leghorn pullets and hens had a distinct beneficial effect on their production when they were forced to undergo a longer feeding and exercising period by the use of artificial light. The birds also ate slightly more feed. When artificial lights were not used no benefits resulted from the feeding of this product, and the authors conclude that the yeast feeding is probably not commercially profitable.

**Report of egg-laying contests for 1923**, R. R. HANNAS and F. H. CLICKNER (*New Jersey Stas., Hints to Poultrymen*, 12 (1923), No. 3, pp. 4).—Preliminary reports of the third (pullet) year of the Bergen County and the first (pullet) year of the third Vineland international egg-laying and breeding contests are given. Previous contests have been noted (*E. S. R.*, 48, p. 576).

**Determinations of the dressed, drawn, and edible percentages of various kinds of domestic birds**, M. A. JULL and W. A. MAW (*Sci. Agr.*, 3 (1923), No. 10, pp. 329–338, figs. 4).—The dressed and edible percentages of different classes of poultry as determined in experiments at Macdonald College are reported. In fattening roasters the dressed weight averaged  $88.98\pm0.22$  per cent of the live weight, the feathers  $7.01\pm0.27$  per cent, and the blood  $4.01\pm0.19$  per cent of the live weight. In roasters weighing 3 to 4 lbs. dressed, the drawn weight made up  $76.28\pm0.27$  per cent and in 4.5 to 5.50-lb. roasters  $77.33\pm0.17$  per cent of the dressed weight.

The edible percentages of other classes of birds were also determined as reported in the table below. The edible material refers to the boneless drawn carcass plus the heart, liver, and gizzard.

Dressing and edible percentages of different classes of poultry.

Class of poultry.	Percentage of live weight.		Percentage edible of dressed weight.
	Dressed weight.	Edible weight.	
	Per cent.	Per cent.	Per cent.
Unfattened broilers.....	88.30±0.72	47.92±0.50	54.27±0.60
Fattened broilers.....	90.81±.38	55.15±.55	60.73±.24
Unfattened roasters.....	88.90±.45	50.55±.54	56.86±.53
Fattened roasters.....	91.70±.17	57.84±.38	63.07±.43
Fattened capons.....	91.97±.28	62.05±.33	67.46±.30
Fattened hens.....	92.03±.24	59.09±.87	64.22±.75
Squab guineas.....	82.52±.47	49.72±.33	60.25±.29
Squab pigeons.....	82.08±.32	60.66±.37	73.94±.45
Ducks.....			60.17±1.10
Geese.....			65.07±.66
Turkeys.....			66.53±.56

**Rabbit breeding**, G. ROBERTSON and W. W. LEE (*Canada Dept. Agr. Bul. 28, n. ser., (1923), pp. 23, figs. 14*).—The principles of housing, breeding, feeding, management, and marketing of rabbits are discussed. A few of the more important breeds are described, and methods for treating the more common diseases are given.

## DAIRY FARMING—DAIRYING.

[**Dairy cattle experiments at the Pennsylvania Station**], P. S. WILLIAMS (*Pennsylvania Sta. Bul. 181 (1923), p. 20*).—The results of two experiments with dairy cattle are reported, both of which are continuations of those previously noted (E. S. R., 49, p. 274).

*A study of the state of maturity of ensilage corn*.—Feeding tests indicate that medium mature silage (ears in roasting stage) will produce about 8.6 per cent more milk than green silage (cut before the corn had reached the milk stage).

*The effect of leaving milk in the udder at the last milking preceding the regular semiofficial monthly test of purebred cattle*.—A total of 80 individual trials of leaving one-fourth of the milk in the udder at the last milking preceding the semiofficial test was found to cause increases of 1.027 per cent in the milk yield, 0.082 per cent in the butterfat test, and 1.851 per cent in the butterfat yield.

**A comparison of early, medium, and late maturing varieties of silage corn for milk production**, W. L. SLATE, JR., B. A. BROWN, G. C. WHITE, and L. M. CHAPMAN (*Jour. Dairy Sci., 6 (1923), No. 5, pp. 382-392*).—The results of a second year's investigations of the comparative feeding value of early, medium, and late maturing silage corn for milk production are reported. The procedure (with slight modifications) and the varieties of corn used were the same as in the first experiment (E. S. R., 48, p. 77), and similar results were obtained. All animals received 50 lbs. of silage daily except one in the early and one in the late groups. Six lbs. of hay were fed daily instead of 4 lbs. as in the first experiment. The feed consumption per 100 lbs. of milk produced was slightly greater in the case of the silage and hay, but less for the grain than in the previous trial.

The average daily production of milk in the early, medium, and late maturing silage lots was 25.5, 20.7, and 22.3 lbs., respectively. The grain required to produce 100 lbs. of milk in the respective lots was 28.9, 34.3, and 39.6 lbs. Based on the composite results for the two years, the authors calculated that 0.77 acre of medium maturing and 0.82 acre of late maturing silage would be required to produce the same amount of milk as 1 acre of early maturing silage.

**Feeding cull beans to dairy cows**, O. E. REED and J. E. BURNETT (*Michigan Sta. Quart. Bul., 6 (1923), No. 2, pp. 43-45*).—In a test comparing culled beans with cottonseed meal as an ingredient of a grain ration consisting of 250 lbs. of ground oats, 200 lbs. of hominy, 200 lbs. of wheat bran, and 175 lbs. of gluten, it was found that by the addition of 124 lbs. of cottonseed meal to this ration the cows lost less weight and produced more milk and butterfat than when 250 lbs. of culled beans were added to the ration. Two groups of six cows each were used in making the tests, which lasted for three periods of 30 days each. The lack of palatability of the beans was an important factor in determining the results.

**Normal growth of the Jersey cow**, C. W. TURNER, A. C. RAGSDALE, and S. BRODY (*Jour. Dairy Sci., 6 (1923), No. 5, pp. 461-465, fig. 1*).—Essentially noted from another source (E. S. R., 49, p. 374).



**Factors influencing percentage of fat in milk,** T. E. WOODWARD (*Jour. Dairy Sci.*, 6 (1923), No. 5, pp. 466-478).—In studying the factors influencing the fat content of milk, the results of experiments carried on at the U. S. D. A. Dairy Division Experiment Farm, Beltsville, Md., are reported.

In view of the fact that prickly pears, which are high in mineral and water content, have been found to lower the fat content of milk, rations containing different amounts of magnesium carbonate, epsom salts, or calcium in the form of steamed bone meal were fed to lots of dairy cows receiving normal, subnormal, and supernormal amounts of water. No significant changes in the fat content of the milk resulted, however, in these tests.

By substituting cottonseed meal or linseed meal for three-fourths of a grain ration consisting of a mixture of 2 parts of hominy, 2 parts of ground oats, 2 parts of wheat bran, 1 part of linseed oil meal, and 1 part of cottonseed meal, it was possible to produce significant increases in the fat percentages of the milk, but practically no increase resulted when gluten feed was substituted. The fat percentage was also increased by feeding 0.7 to 1 lb. of linseed oil per cow daily. Later experiments showed that the increased fat percentage due to linseed oil meal only lasted about 10 days, as the cows then returned to their normal percentage when continued longer on the linseed oil meal. It is concluded that the rise in the fat content was due to the oil when cottonseed meal and linseed meal were fed rather than to the high protein content.

Tests of the effect of exercise on the fat content showed that in a total of 22 comparisons all except two individuals showed an increased fat content of the milk when they were exercised as compared with the fat content during periods of rest. A study of the butterfat tests in July and January of 830 samples of milk of both grade and purebred Jerseys, Guernseys, and Holsteins showed that the average differences for each breed were from 0.04 to 0.72 per cent, averaging 0.33 per cent higher in January than in July. The results thus indicate that hot weather tends to lower the fat content of the milk.

**Paying for milk on a quality basis as a means of improving the supply,** L. H. COOLEGE and O. T. GOODWIN (*Michigan Sta. Circ. Bul.* 61 (1923), pp. 3-13, figs. 3).—A comparison of the quality of the milk delivered at a city milk plant during the years 1920, 1921, and 1922 has been made by the colorimetric H-ion method. During 1920 there was no supervision of the supply and the quality was very low. During 1921 a quality contest, previously described (*E. S. R.*, 47, p. 281), resulted in good quality milk while the contest lasted, with a return to poor-quality milk after the conclusion of the contest. In 1922 a bonus of 15 cts. per 100 lbs. was paid for 3.5 per cent milk having a pH score of over 75, and by this method the quality of the milk was maintained at a fairly high level throughout most of the summer.

Other studies indicate that proper cooling was the biggest factor in maintaining good quality, and that milk produced by renters was of lower grade than that produced by farm owners.

**The bacterial content of cow feces,** P. W. ALLEN (*Jour. Dairy Sci.*, 6 (1923), No. 5, pp. 479-482).—In studying the bacterial content of cows' feces, cultures were made on standard beef extract agar at the Illinois and New York Cornell Experiment Stations from 50 samples of feces when fresh and after being dried at 37° C. for 48 hours on porous plate covers. Tubes of litmus milk were then inoculated with 250 of the representative colonies and incubated 30 days at 20°. The organisms were then classified. The study revealed that the samples of dried feces contained many more bacteria per gram than the fresh



feces. The bacterial counts per gram of fresh feces varied from 160,000 to 634,000,000, whereas the dried samples varied from 500,000,000 to 16,800,000,000.

**Creamery inspection in New Jersey**, F. C. BUTTON (*New Jersey Stas. Circ.* 157 (1923), pp. 16, figs. 3).—This is the usual report of the creamery inspections in New Jersey for the year ended June 30, 1923 (E. S. R., 48, p. 176).

**The relation of the oxidizability value and the amino and ammonia nitrogen content to the quality of cream and butter**, L. W. FERRIS (*Jour. Dairy Sci.*, 6 (1923), No. 5, 412-426).—A study has been made of the relation of the oxidizable value and the amino and ammonia nitrogen content to the quality of the cream and butter of 13 factories, based on the methods for the determination previously described (E. S. R., 48, p. 206) and in an article by the author and others.<sup>1</sup> Samples of cream and butter were submitted from each factory, specifications were made as to whether the cream was considered as first or second grade, and the results were grouped accordingly.

The amino nitrogen and ammonia as percentage of the total nitrogen averaged in the samples from the different plants for first grade cream from 1.6 to 9.6 per cent and for second grade cream from 8.1 to 12.6 per cent, and for the butter made from first grade cream from 0.8 to 6.3 and from second grade cream from 4.7 to 6.7, except for one factory in which the content was 12.9. The high content from this one factory was explained as due to a delay in making the analyses. The plants producing butter containing the smaller amounts of amino nitrogen and ammonia as percentage of the total nitrogen (0.8 to 1.2 per cent) had a low oxidizable value (0.4 to 1.1) and scored high (93+). There was a general decrease in the score and an increase in the oxidizable value of the butter made from cream with a high amino nitrogen and ammonia content. Bacteriological counts were made on the cream from two plants, but no definite relationship to the other factors studied was noted. The amino nitrogen and ammonia as percentage of the total nitrogen in the samples of milk from 11 individual cows varied from 2.2 to 3.6 per cent, averaging 2.8 per cent.

**A study of the action of certain bacteria, yeasts, and molds on the keeping quality of butter in cold storage**, M. GRIMES (*Jour. Dairy Sci.*, 6 (1923), No. 5, pp. 427-445).—This study is reported from the Iowa Experiment Station. Raw sweet cream was pasteurized at 145° F. for 25 minutes, and samples of butter were made from it after receiving the following treatments: Lot 1 sweet pasteurized cream having an acidity of 0.14 to 0.21 per cent, lot 2 pasteurized sweet cream with 10 per cent starter added but not ripened, lot 3 pasteurized sweet cream with starter added and ripened to serum x 0.0063, and lot 4 pasteurized sweet cream with starter added and ripened to an acidity of 0.5 to 0.61 per cent. Lots 2, 3, and 4 were divided into several portions, and pure cultures of the microorganisms to be tested were added to the different portions before churning.

The organisms tested, in addition to those in the starter (*Streptococcus lactis* and *S. paracitrovorus*), included *Bacterium ichthyosmius*, *Oidium lactis*, three types of common white yeasts, two types of yeast forming spreading colonies on whey agar, and pink yeasts. The types and numbers of bacteria in the cream before and after pasteurization, the acidity of the cream before churning, and the bacterial content and score of the butter before and after storage are recorded in tables. Pasteurizing the cream destroyed an average of 99.55 per cent of the organisms present in the raw sweet cream. Of the organisms in the raw cream 71 per cent were of the *S. lactis* type, but practically none

<sup>1</sup> Jour. Dairy Sci., 4 (1921), No. 6, pp. 521-535.



survived pasteurization. No molds or yeasts were found in the pasteurized cream.

The butter made from cream inoculated with proteolytic organisms, *B. ichthyosmii*, *O. lactis*, or the molds did not show any significant decrease in score even after six months' storage at  $-6^{\circ}$  F. Bacterial counts of the butter indicated that a few types of organisms, notably resistant strains of *S. lactis*, slow *S. lactis* type, *S. paracitrovorus*, lactic acid forming, noncoagulating, non-citric acid fermenting streptococci, various types of micrococci, inert types, alkali-forming types, and proteolytic types, lived over in the butter after six months' cold storage. The score of some butter made from cream to which starter had been added decreased from a score of 92 to 88 per cent during storage, while comparative samples of sweet cream butter practically held their scores.

Evidence was presented to show that *S. lactis* and *S. paracitrovorus* are not a direct cause of deterioration, since sweet cream butter churned from cream to which starter had been added had a higher score after storage than regular sweet cream butter.

**Problems in the manufacturing of ice cream,** W. B. COMBS (*Pennsylvania Sta. Bul.* 181 (1923), p. 20).—A continuation of this study (E. S. R., 49, p. 277) by the use of the McMichael viscosimeter indicates that the development of viscosity in the ice cream mix is not in direct ratio with acid development. The rate of viscosity development is most rapid during the first 48 hours. Pasteurization tends to decrease viscosity, but during aging a large part of the viscosity may be regained. A pressure of 2,000 lbs. or more is recommended for efficient work on the viscosity process.

**A study of the relation of the composition of the mix to the quality of the finished ice cream,** A. S. AMBROSE (*Jour. Dairy Sci.*, 6 (1923), No. 5, pp. 446-454).—The effect of changes in the composition of fat and solids on the quality of ice cream mixes, as determined by texture, resistance, body, flavor, and stability, was studied at the Illinois Experiment Station. Twenty different mixes were compared containing 8, 10, 12, and 14 per cent of fat, with 6, 10, 12, 14, and 18 per cent of milk solids-not-fat with each fat percentage. All mixes contained 12 per cent of cane sugar and 0.5 per cent of gelatin.

The results were tabulated and compared as to the effect of total milk solids, milk solids-not-fat, and butterfat content. Mixes low in total milk solids and solids-not-fat were coarse in texture, light in body, and lacked resistance, whereas the mixes high in those constituents were too resistant and soggy in body. The effect of the total milk solids seems to be more dependent on whether they are the result of a high fat content or a high content of solids-not-fat than on the total amount of solids. The ice cream high in solids-not-fat often developed a condensed milk flavor and sandiness when stored. With the proper amount of milk solids-not-fat, additional amounts of fat seemed to produce smoother texture, greater resistance, a more desirable body, and better flavor, but there is an upper limit beyond which the amount of fat should not go.

**A greenish-black discoloration of chocolate ice cream,** A. C. DAHLBERG (*Jour. Dairy Sci.*, 6 (1923), No. 5, pp. 455-460).—The occurrence of a greenish-black color in chocolate ice cream on standing is described from the New York State Experiment Station. This condition was found to be due to a chemical reaction between tannins present in the cocoa and rust spots on the cans. It may be prevented by the use of well tinned or paper lined cans or the use of cocoa that does not contain tannins of the type which form this compound. Only 3 of 8 samples of cocoa examined were able to produce the color.

## VETERINARY MEDICINE.

**A textbook of bacteriology**, H. ZINSSER and F. F. RUSSELL (*New York and London: D. Appleton & Co., 1922, 5. ed., rev. and enl., pp. XIV+1193, figs. 164*).—In this revision of the volume previously noted (E. S. R., 39, p. 283) the subject matter has been almost entirely rewritten, with several changes in the manner of presentation and the incorporation of much new material as well as the elimination of some of the material of the previous edition. In the section on technique many methods no longer in use have been omitted, and the newer methods of titration have been added. The general section on infection and immunity has been simplified. In the section on pathogenic organisms more emphasis has been placed upon prevention by the addition of clinical data and the discussion of the principles underlying sanitary procedure. Of particular interest in this section are the chapters on the anaerobic bacilli, *Bacillus anthracis* and anthrax, *B. mallei* and glanders, and *B. melitensis*, *B. bronchisepticus*, bacillus of cattle abortion, bacillus of guinea pig pneumonia, and *B. pyocyaneus*.

The section dealing with pathogenic molds has been rewritten by J. G. Hopkins. The sections dealing with the chemical metabolism of bacteria have been revised by J. H. Muller, and the chapter dealing with the anaerobic infections concerned in traumatic injuries by A. Kuttner.

**Investigations into the occurrence and classification of the hemoglobophilic bacteria**, M. KRISTENSEN (*Copenhagen: Levin & Munksgaard, 1922, pp. 272, pls. 3, figs. 1*).—The first part of this work (pp. 13–64) consists of a historical review. The parts that follow, which deal with the author's investigations, relate, respectively, to Pfeiffer's bacillus (pp. 67–97), analysis of the bacterial group "Pfeiffer's bacillus" (pp. 98–204), a comparison between Pfeiffer's bacillus and other hemoglobinophilic bacteria (pp. 205–224), and technique (pp. 225–247).

**The results of recent studies on pathogenic anaerobes**, M. KNORR (*Zentbl. Gesam. Hyg., 4 (1923), Nos. 2, pp. 81–100; 3–4, pp. 161–180*).—This is a review of the literature on pathogenic, anaerobic, spore-forming microorganisms, particularly those responsible for tetanus, botulism, anthrax, and malignant edema. A list of 361 references to the literature is appended.

**Vaccination by ingestion**, A. CALMETTE (*Ann. Inst. Pasteur, 37 (1923), No. 10, pp. 900–920*).—A critical review of the literature on the subject, particularly with respect to the use of the oral route for vaccination against typhoid and paratyphoid fever, bacillary dysentery, cholera, tuberculosis, pyogenic infections, diphtheria, and rinderpest.

**Microbic virulence and host susceptibility in paratyphoid-enteritidis infection of white mice.**—III, **The immunity of a surviving population**, L. T. WEBSTER (*Jour. Expt. Med., 39 (1924), No. 1, pp. 129–135, figs. 2*).—In this continuation of the investigation previously noted (E. S. R., 49, p. 882), a study has been made of the nature of the resistance to further outbreaks of mouse typhoid of those which survived a previous outbreak either through actually resisting the disease or recovering from it. The conclusions drawn are as follows:

"Mice which survive a preliminary dose per os of paratyphoid-enteritidis bacilli are more resistant to a second dose per os of a similar epidemic mouse typhoid strain than are mice which have received no preliminary culture. The amount of this resistance is related to the pathogenicity of the preliminary strain more than to its antigenic similarity to the second strain. Mice which survive a preliminary dose per os of paratyphoid-enteritidis



bacilli are more resistant to a lethal dose of mercury bichlorid per os than are mice which have not received the preliminary bacterial culture. Mice which have resisted and mice which have recovered from a preliminary dose per os of paratyphoid-enteritidis bacilli are more resistant to a lethal intraperitoneal dose of an epidemic mouse typhoid strain than are mice which have not received the preliminary culture. Mice in which the preliminary dose of paratyphoid-enteritidis bacilli has induced a chronic infection readily succumb to a second dose of such bacilli. These findings indicate that the resistance mechanism of the host contains important nonspecific factors which vary in degree with the individual mice."

**The absorption of specific agglutinins in homologous serum fed to calves during the early hours of life,** T. SMITH and R. B. LITTLE (*Jour. Expt. Med.*, 37 (1923), No. 5, pp. 671-683).—Further data are reported which confirm the conclusions previously drawn concerning the importance of colostrum to the newborn calf (*E. S. R.*, 48, p. 86) and the possibility of substituting cow serum for colostrum (*E. S. R.*, 48, p. 180).

O 3 newborn calves receiving colostrum all survived in normal condition. Of 3 receiving ordinary milk 2 died and 1 remained normal, and of 4 receiving cow serum all survived but 1 became affected with pneumonia, resulting in extensive necrosis of the lung tissue. The serum was fed in one case in three small doses of milk and in the other in one dose of from 500 to 650 cc. without milk. In all of the cases absence of agglutinins at birth was demonstrated, with prompt rise in agglutinins following the ingestion of colostrum or serum. The blood titer was not increased by feeding after the first meal, nor did the feeding of serum 3.5 to 13 days after birth alter the blood titer.

"The facts presented have certain bearings on practice. The newborn calf should receive its protective meal as soon as possible after birth. This may be fed from a nursing bottle if the animal is too weak to stand up and suckle the dam. When the udder of the dam is diseased or suspected of carrying dangerous infectious agents, such as tubercle bacilli, and the calf worth raising, cow serum may be fed in place of the colostrum. The protective action of serum appears to remain intact for months if it is properly collected and stored. It should not contain antiseptics until the harmlessness of such agents has been proved. One meal of 500 to 700 cc. is protective, but it should be reinforced whenever possible by subcutaneous or intravenous injection soon after birth if the serum is clear and free from molds."

**Studies of cottonseed poisoning.**—I, The pathological tissue changes resulting from continuous feeding of cottonseed meal, S. A. GOLDBERG and L. A. MAYNARD (*Jour. Amer. Vet. Med. Assoc.*, 62 (1923), No. 4, pp. 450-457, figs. 6).—This is a report of pathological studies conducted by the departments of comparative pathology and animal husbandry at Cornell University. The authors find that the lesions in cottonseed injury are generalized edema; that the initial lesion, apparently, is ascites; and that the poisonous substance may be transmitted through the milk.

**Annual report on veterinary work for the year 1922** (*Aarsberet. Vet. Fysikat.* [Denmark], 1922, pp. VI+162, pl. 1).—This is an annual report on the occurrence of and work with diseases of livestock in the 23 departments of the country.

**Annual administration reports of the Bombay Veterinary College, Glanders and Farcy Department, and Civil Veterinary Department in the Bombay Presidency (including Sind) for the year 1922-23,** K. HEWLETT, E. S. FARBROTHER, L. J. MOUNTFORD, and J. H. G. JERROM (*Bombay Vet. Col., Glanders and Farcy Dept., and Civil Vet. Dept. Ann. Admin. Rpts.*, 1922-23, pp. 61).—



These annual reports (E. S. R., 48, p. 480) present information, largely in tabular form, on the occurrence of infectious diseases of livestock, etc.

**Annual reports on the Punjab Veterinary College, Civil Veterinary Department, Punjab, and the Government Cattle Farm, Hissar, for the years 1919-20, 1920-21, 1921-22, and 1922-23,** S. M. JACOBS, C. A. H. TOWNSEND, D. MILNE, ET AL. (*Punjab Vet. Col. and Civ. Vet. Dept. Ann. Rpts., 1919-20, pp. [41]+XXVIII, pls. 6; 1920-21, pp. [40]+XXVIII, pls. 3; 1921-22, pp. [41]+XXVIII, pls. 3; 1922-23, pp. [57]+XXVIII, pls. 3*).—These, the usual annual reports (E. S. R., 45, p. 382), include data on the occurrence of and control work with infectious diseases of livestock.

**On the serum therapy of glanders with special reference to glanders in man,** E. A. WATSON (*Jour. Amer. Vet. Med. Assoc., 64 (1923), No. 2, pp. 146-153*).—Reports are given of three cases of human glanders which were treated successfully with antimallein serum prepared by the method of Watson and Heath (E. S. R., 47, p. 881). The details are also given of the production and titration of the serum used.

**The cultivation of the rinderpest virus in vitro,** F. C. MINETT (*Jour. Compar. Path. and Ther., 36 (1923), No. 4, pp. 205-216*).—The author reports upon attempts to cultivate the virus of rinderpest in vitro after the method described by Boynton (E. S. R., 31, p. 677). The results obtained strongly suggest that the apparent success of Boynton in cultivating it is susceptible of other explanations than that the virus actually multiplied.

**Staggers or shivers in livestock,** S. DODD and M. HENRY (*N. S. Wales Dept. Agr., Sci. Bul. 23 (1923), pp. 24*).—This is a popular summary of information on an enzootic and apparently noncontagious affection of horses, cattle, and sheep occurring in certain parts of New South Wales.

**Tuberculin sensitiveness caused by dead tubercle bacilli,** A. B. CRAWFORD (*Jour. Amer. Vet. Med. Assoc., 64 (1923), No. 2, pp. 228-230*).—Data are reported from the Experiment Station of the Bureau of Animal Industry, U. S. D. A., on the sensitiveness to tuberculin, injected intra-abdominally, of guinea pigs previously injected with varying doses of killed tubercle bacilli suspended in physiological salt solution.

Sensitization was first observed about two weeks after the injection of the dead bacilli. It increased until at the end of four weeks an injection of 2 cc. of tuberculin per 500 gm. weight, and at the end of the seventh week an injection of 1 cc., was generally fatal. From the seventh to the eighteenth week the degree of sensitization was stationary, and after 28 weeks a marked decline was apparent.

**Contagious abortion of bovines and its prevention,** J. T. EDWARDS (*Rev. Zootéc. [Buenos Aires], 10 (1923), Nos. 120, pp. 257-271; 121, pp. 289-304; 122, pp. 321-327*).—A summary of information on this disease.

**The occurrence of the abortion bacillus in the milk of infected cows,** A. L. SHEATHER (*Jour. Compar. Path. and Ther., 36 (1923), No. 4, pp. 255-266*).—This is a contribution from the Research Institute in Animal Pathology, Royal Veterinary College, London.

“Examination of 50 examples of milk obtained from animals giving positive reactions to the agglutination test for contagious abortion has shown that abortion bacilli were present in 17 of them. The presence of the bacilli was detected by inoculating guinea pigs and testing their blood at intervals after inoculation by agglutination. In view of the necessity of detecting all infected animals in a herd for the purposes of control of contagious abortion, the failure of whey to give positive results in rather more than 14 per cent of cases indi-



states that whey is not a suitable substitute for serum. The great divergence of the results obtained in agglutination tests with whey and serum indicates that there is no constant relationship in their agglutinin content."

**Progressive pernicious anemia of bovines in Cochin China**, G. LE LOUET and L. BROUDIN (*Bul. Soc. Path. Exot.*, 16 (1923), No. 8, pp. 575-580).—This is a preliminary note in which the authors record the occurrence in Cochin China of a specific disease, not previously described as occurring in that country, which causes a high mortality and to which they give the name progressive pernicious anemia of bovines. This disease, which may become epizootic, has been observed to cause the death of 200 out of 300 animals.

**Progressive pneumonia in sheep**, H. MARSH (*Jour. Amer. Vet. Med. Assoc.*, 62 (1923), No. 4, pp. 458-473, figs. 8).—This is an account of an affection of sheep which is the cause of a considerable loss every year in Montana. The mortality is considered to be 100 per cent, and in affected bands the annual loss averages from 2 to 10 per cent. The author reports the details of six cases as illustrative of the different pathological conditions found in the disease. Cooperative experiments are now being carried on by the Montana Live-stock Sanitary Board and the Montana Experiment Station in an attempt to determine the etiology of the disease. The pathological condition found in this disease is apparently confined almost entirely to the lungs and the thoracic lymph glands, and there are no recognizable symptoms until the involvement of the lung is sufficient to cause labored respiration. Brief references to this disease have been noted (*E. S. R.*, 48, p. 877; 50, p. 182).

**The significance of post vaccination trouble**, E. A. CAHILL (*Jour. Amer. Vet. Med. Assoc.*, 64 (1923), No. 2, pp. 171-183).—In order to obtain definite information on the cause of so-called "cholera breaks" in hogs subsequent to vaccination for hog cholera, samples of blood were obtained from 210 animals in the height of the attack. Two presumably susceptible pigs were inoculated with from 5 to 10 cc. of each sample and were then kept in confinement from 8 to 10 days. If the animals remained well they were each inoculated with 2 cc. of hog cholera virus of known strength to prove their susceptibility. The blood was also tested bacteriologically and by injection into rabbits, mice, or guinea pigs.

Of 152 samples of blood obtained from sick hogs vaccinated from 4 to 30 days previously, 80.3 per cent proved negative to hog cholera and 19.7 per cent positive, while of 48 samples obtained from sick hogs vaccinated more than 30 days previously, 68.8 were negative and 31.2 per cent positive. The bacteriological studies conducted on the 140 cases in which hog cholera virus could not be identified gave negative results in the blood in 41 cases, lungs 37, liver 109, spleen 85, kidney 115, and glands 103. Microorganisms found in significant numbers were *Pasteurella suisseptica* and *Bacterium paratyphosum B*. The cases from which these were isolated presented clinical evidence of these infections.

The immunity of 18 herds which had been vaccinated with the same serum-virus used in some of the cases in which outbreaks had occurred was tested by injection of the animals with 10 cc. of virus. No susceptible animals were discovered. The immunity of 36 other herds was tested by subjecting the animals to hyperimmunization. Again no susceptible animals were found.

"The obvious conclusion to be drawn from this survey is that in the particular cases investigated the cholera breaks which occurred were not the result of inability on the part of the products to accomplish their purpose, but that the desired results failed of accomplishment because some undetermined factor unbalanced the normal relationship between host and antigen."

**The intravenous injection of a solution of formaldehyde in purpura hemorrhagica in horses**, J. McCUNN (*Canad. Vet. Rec.*, 4 (1923), No. 4, pp. 230, 231).—The author reports briefly upon successful results obtained after intravenous treatment with formaldehyde solution. From one to three injections of 1 oz. in 10 oz. of sterile water each were given.

**Limberneck of fowls produced by fly larvae**, F. C. BISHOP (*Jour. Parasitol.*, 9 (1923), No. 3, pp. 170-173).—Feeding experiments with fly larvæ are briefly reported upon. It was found that *Chrysomya macellaria* larvæ reared in carcasses of limberneck fowls and fed to healthy fowls are capable of producing limberneck, and that other blowfly larvæ may cause the disease under like conditions.

“The causative agency of limberneck may be carried by larvæ reared in a limberneck carcass through the pupa and adult stage to the larvæ of the next generation reared in beef. Meat from limberneck carcasses fed to fowls will cause limberneck. Larvæ which have ceased feeding on infective carcasses, either on account of becoming full grown or through removal, and have more or less cleaned themselves by voiding infective material from the digestive tract and by burrowing through soil are less likely to produce limberneck when fed to fowls. Washings from maggots fed on limberneck material are apparently not very toxic when given to fowls by mouth. A considerable amount of infected material is necessary to produce marked cases of limberneck in fowls. Certain breeds may be more resistant to limberneck than others.

“Blowfly larvæ reared on putrid beef offal and liver are often noninjurious to fowls even though eaten in large numbers. Putrid liver and beef offal and carcasses of healthy chickens are often nontoxic even though eaten by fowls in considerable amounts, and larvæ of flies from such nontoxic material will not produce limberneck. In other words, it appears that there is a specific causative agency, whether *Bacillus botulinus* or some related form, which when partaken of in quantity, either in meat or in fly larvæ which have fed on such infested material, may produce limberneck. The need of disposal by burning of all carcasses, especially those which have died of limberneck, is further emphasized.”

**Observations on the life cycle of *Davainea proglottina* in the United States**, A. C. CHANDLER (*Amer. Micros. Soc. Trans.*, 42 (1923), No. 3, pp. 144-147, figs. 2).—The author reports having discovered *D. proglottina* during examinations of slugs (*Agriolimax agrestis*) at Houston, Tex. The cysticeroids were identified by feeding to hens, in the droppings of which active proglottids of *D. proglottina* were discovered 20 days later in considerable numbers. The occurrence of *D. proglottina* in the United States was recorded by Ransom (*E. S. R.*, 23, p. 488) in 1909 from Pennsylvania and Maryland, thus indicating a rather wide distribution in this country.

## RURAL ENGINEERING.

**Twenty years of reclamation**, F. H. NEWELL (*Engin. News-Rec.*, 91 (1923), No. 20, pp. 801-807, figs. 3).—This is one of a series of articles on the history and performance of reclamation by the U. S. Reclamation Service in which the 20 years of activities are reviewed, special attention being drawn to the problems encountered and the conditions affecting the success of reclamation. It is concluded that the reclamation law has been a success, but that it can be made a greater success in the future if the creation of rural homes is kept clearly in mind as the object to be attained.



**Annual report of the Reclamation Service, 1921-22**, E. F. DRAKE (*Canada Dept. Int., Reclam. Serv. Ann. Rpt., 1921-22, pp. VI+102, pls. 3, figs. 14*).—This report presents data and information on the work, expenditures, and progress of public and private irrigation enterprises in Canada during the fiscal year 1921-22. Among other special features, the progress results of duty of water investigations at Brooks, Vauxhall, and Coaldale are presented. These indicate that even during the past five dry seasons in southern Alberta there has been enough precipitation, when added to the legal duty, to produce the optimum possible duty.

**A study of some of the smaller undeveloped water powers of Tennessee**, J. A. SWITZER (*Tenn. Dept. Ed., Div. Geol. Bul. 30 (1923), pp. 24, pls. 36, fig. 1*).—This report briefly describes the important features of some of the smaller undeveloped water powers of Tennessee, and presents engineering information of value in their development.

**Experiments on loss of head in valves and pipes of one-half to twelve inches diameter**, C. I. CORP and R. O. RUBLE (*Wis. Univ. Bul., Engin. Ser., 9 (1922), No. 1, pp. 143, pl. 1, figs. 54*).—The results of 2,200 tests on 48 different gate and globe valves and the results of 425 tests to determine pipe friction are presented in this bulletin.

The loss of head due to gate valves from  $\frac{1}{2}$  to 12 in. in diameter was measured for openings of  $\frac{1}{8}$ ,  $\frac{1}{4}$ ,  $\frac{3}{8}$ ,  $\frac{1}{2}$ , and  $\frac{3}{4}$  in., and for full openings. The loss of head due to globe valves from  $\frac{1}{2}$  to 2 in. in diameter was determined under fully open conditions. The loss of head in pipes of from  $\frac{1}{2}$  to 12 in. in diameter was determined as a part of the valve experiments.

The results showed that the loss of head due to valves and other fittings occurs in part within the valve or fitting and in part as an added loss in the pipe line downstream where normal flow has been disturbed. Measurement of the loss of head where the downstream piezometer was attached too near the valve indicated a loss in excess of that actually produced. From 20 to 25 pipe diameters beyond the valve gave usually the best position for the downstream piezometer opening. It is considered undesirable to have a greater length of pipe in the gauge length than is actually needed to include the valve loss.

The loss of head in new, clean wrought iron pipe from  $\frac{1}{2}$  to 12 in. in diameter was found to be indicated approximately by the formula  $H = \frac{0.0319}{d^{1.16}} v^{1.9}$  in which  $H$  is the loss of head in feet per 100 ft. of pipe,  $v$  is the velocity of flow in the pipe in feet per second, and  $d$  is the pipe diameter in feet. Globe valves offered from 15 to 40 times the resistance of gate valves of the same size. This ratio increased with the increase in the size of the valves.

The length of straight pipe of the valve size which produced the same loss of head varied from  $\frac{3}{4}$  to 4 ft. for fully open gate valves and from 20 to 35 ft. for fully open globe valves. In the case of globe valves, the smaller valves were equivalent to the greater length of pipe measured in pipe diameters.

A bibliography and numerous appendixes giving tables of data and analyses of specific features of the subject are included.

**Cost of pumping for irrigation**, O. L. WALLER (*Wash. State Col. Ext. Bul. 103 (1923), pp. 23, fig. 1*).—Practical information on the cost of pumping for irrigation, with special reference to conditions in the State of Washington, is presented in this bulletin.

**The irrigation of sugar cane in Hawaii**, W. P. ALEXANDER (*Honolulu: Hawaii. Sugar Planters' Sta., 1923, pp. [5]+109, figs. 63*).—A detailed description of irrigation practices in the growing of sugar cane in Hawaii is presented

in this report, together with the results of special studies on specific phases of the application and utilization of irrigation water.

Soil moisture studies on three different areas of cane soils showed that the maximum moisture-retaining capacity of these soils was 4 acre-in. for each foot of soil at depths of 1 and 2 ft. The more compact soil had a range of from 3 to 3.5 acre-in. at lower depths. The results are taken to indicate that the saturation of these soils with water is reached when the percentage of moisture is a trifle over 30, and that irrigation water applied after this point is reached is wasted.

In warm weather the wilting point of cane occurred when the soil moisture was below 21 per cent. In winter the soil moisture went as low as 20 per cent without causing wilting.

Studies on soil water movement showed practically no capillary movement of the water from the lower to the upper strata of the soil. The drying out process proceeded downward, being rapid in the first 2 ft. There was a tendency for gravity to pull the water down for a period as long as 48 hours after irrigation water was applied. The opinion is expressed that the application of soil moisture determinations to the plantation routine, in order to decide when and how much to irrigate, is not practical under ordinary conditions.

A large amount of data from a number of other experiments from different sources is summarized and discussed, and a bibliography is appended.

**Irrigation in India, 1921-22** (*India Dept. Indus. and Labor, Pub. Works Branch, Irrig. India Rev. 1921-22, pp. [3]+13+27*).—A comprehensive account of the State irrigation works in India during the fiscal year 1921-22 is presented in this report.

**Sodatol, a new agricultural explosive**, A. J. ADAMS (*Michigan Sta. Quart. Bul., 6 (1923), No. 2, pp. 52, 53*).—A brief description is given of Sodatol, a new agricultural explosive consisting of a combination of sodium nitrate and TNT. It is stated that Sodatol overcomes the majority of the drawbacks of picric acid and TNT. It has been found to be fully as powerful as 40 per cent dynamite.

**Road materials of Kansas**, C. H. SCHOLER (*Kans. Engin. Expt. Sta. Bul. 12 (1922), pp. 51, figs. 5*).—A summary of the results of tests made upon the natural road-building materials of Kansas is presented in this bulletin, which is in two parts. Part 1 sets forth the desirable materials for use in highway construction, based very largely on the results obtained by the Kansas Highway Commission, and includes a brief, nontechnical discussion of the methods used in testing highway materials. Part 2 presents the results of tests tabulated by counties and by classes of materials.

**Report of highway research at Pittsburg, Calif., 1921 and 1922**, L. ALDRICH and J. B. LEONARD (*Sacramento: Calif. Dept. Pub. Works, 1923, pp. 146, figs. 120*).—The methods and results of the highway tests at Pittsburg, Calif., conducted in cooperation with the U. S. Department of Agriculture, are presented in detail and discussed in this report. An introductory statement by A. B. Fletcher and L. I. Hewes is included. Progress reports of these tests have been noted from time to time in the *Record*.

The final results showed that the method of constructing the subgrade on adobe soil by plowing, scarifying, pulverizing, sprinkling, and rolling in 6-in. layers so reduced the objectionable features of this material that a reliable foundation for the pavements resulted. This subgrade was not injured by the water which filled the side ditches for three months. The unsurfaced concrete



completely resisted all surface wear due to solid rubber-tired traffic. The limited metal-tired traffic was found to cause an early failure of the surface, with sufficiently heavy loads. Early morning traffic was potentially more injurious to the pavement than the day traffic. Observed deflections of the pavements were very nearly directly proportional to the loads.

Those sections that had steel placed in such positions as to enable it to resist the tension flexural stresses were more durable than those sections of the same dimensions that did not contain steel so placed. Rock ballast was less efficient than the earth subgrade.

[**Shingle and shingle nail experiments at the Pennsylvania Station**], J. A. FERGUSON (*Pennsylvania Sta. Bul.* 181 (1923), p. 21).—Studies of the durability of treated and untreated shingles, begun in 1909 and including untreated western red cedar, redwood, and chestnut, and creosoted loblolly pine, pitch pine, and chestnut, showed after 14 years no notable difference in the durabilities of the woods, but considerable difference in the physical properties that make them valuable for use in shingles. Pitch pine showed a tendency to excessive warping, curling up at the ends, and splitting. Loblolly pine shingles, on the other hand, lie flat with little checking, the physical properties comparing favorably with western red cedar and redwood. Creosoted chestnut shingles showed less warping and splitting than those not creosoted.

A shingle nail experiment begun in 1914 showed that after 9 years no difference could be noted in the lasting qualities of wire nails, blue cut, zinc clad, pure zinc, and copper nails.

**On the drying of timber**, R. T. PATTON (*Roy. Soc. Victoria Proc., n. ser.*, 35 (1922), No. 1, pp. 63–85, figs. 10).—Studies on the factors involved in the drying and seasoning of timber, including moisture content, diffusion of moisture, evaporating surface, thickness, humidity, and temperature, are reported, with particular reference to Australian timbers. A considerable amount of graphic data is given, but no conclusions are drawn.

**Low temperature tars and wood preservation**, R. P. SOULE (*Amer. Wood Preservers' Assoc. Proc.*, 19 (1923), pp. 114–127, figs. 9).—Studies are reported, the results of which are taken to indicate that the low temperature creosotes have the same penetration and absorption as ordinary creosotes. Their resistance to evaporation and leaching is greater, their toxicity is considerably higher, and they are even less corrosive to steel and brass than the coke oven and gas works products.

**Reinforced concrete**, R. J. H. HUDSON (*London: Chapman & Hall, Ltd.*, 1922, pp. XXIV+318, pls. 8, figs. 141).—This is a practical handbook which explains the theory of reinforced concrete, and includes tables, charts, data, and other information for practical use in designing and executing reinforced concrete construction. It is divided into three parts. Part 1 deals briefly with materials, and construction. Part 2 is devoted to the design of beams, slabs, and pillars, the preparation of materials, and contains a chapter on the complete design of a floor supported by pillars. Part 3 discusses secondary stresses in monolithic structures. Numerous appendixes dealing with specific phases of reinforced concrete design are included.

**Intra-company standardization and its relation to general standardization**, E. A. JOHNSTON and O. B. ZIMMERMAN (*Agr. Engin.*, 4 (1923), No. 12, pp. 187–190, 191, fig. 1).—This paper outlines the general principles of the standardization of farm equipment, with particular reference to design, development, and manufacture.

**Power wagon reference book, 1923** (*Chicago: Power Wagon Pub. Co., 1923, 3. ed., pp. 404, illus.*).—This is an extensive encyclopedia of the use of automotive power in the various leading industries, and of the mechanical details of different automotive apparatus. A special section deals with the farm tractor, its design, application, and economy.

**Dynamometer tests of automobile tires**, W. L. HOLT and P. L. WORMELEY (*U. S. Dept. Com., Bur. Standards Technol. Paper 240 (1923), pp. 559–579, pls. 3, figs. 12*).—Continuing work previously noted on power losses in automobile tires (*E. S. R., 48, p. 90*), power loss tests made on a large number of 3.5-, 4-, and 5-in. tires, both cord and fabric, are reported.

An analysis made of the effect of the different parts of the tire on the power loss showed that the carcass is responsible for the greater part of the loss. It is concluded that in the average car, running on a hard, level road at 20 miles per hour, approximately one-half of the power developed by the engine is used in overcoming the rolling resistance of the tires.

**Fabric stresses in pneumatic tires**, H. F. SCHIPPEL (*Indus. and Engin. Chem., 15 (1923), No. 11, pp. 1121–1131, figs. 27*).—This is a mathematical analysis of fabric stresses in pneumatic tire carcasses.

**Efficiency of storage batteries**, A. G. TYLER (*Agr. Engin., 4 (1923), No. 11, p. 176*).—Studies conducted at the University of Minnesota on the efficiency of three 32-volt lead acid batteries of different ages and makes under actual farm conditions are reported. The results indicate that no battery, new or old, of the kind tested will have an efficiency of much over 75 per cent, particularly when handled as they generally are on the farm.

**Conditions for supplying electric service to rural consumers**, E. A. STEWART (*Agr. Engin., 4 (1923), No. 11, pp. 171–176, 183*).—In a contribution from the University of Minnesota, the results of a study made in the State on the conditions to be met in supplying electric service to farms are presented. It is concluded that the best method of bringing electric service to the farm is that in which the lines are built by the public utility and the cost thereof paid by the consumer on an actual cost basis, with due consideration for the degree of benefit obtained. It is further concluded that service charges should be based on a low rate with a fixed minimum charge. A model plan of contract for securing such service is given.

**Poultry housing**, A. W. RICHARDSON and P. I. FITTS (*N. H. Univ. Ext. Circ. 56 (1923), pp. 15, figs. 10*).—Practical information on the planning and construction of poultry houses adapted to New Hampshire conditions is presented, together with working drawings and bills of materials for specific structures.

**Building plans and bill of materials for O. A. C. 400-hen laying house**, F. L. KNOWLTON (*Oregon Sta. Circ. 51 (1923), pp. 4, pl. 1, figs. 3*).—Building plans and a bill of materials for the construction of a 400-hen laying house adapted to Oregon conditions are presented.

**Unit system laying house for large flocks**, A. F. GANNON (*Ga. Agr. Col. Circ. 96 (1923), pp. 4, figs. 3*).—Brief practical information on the planning of a unit system laying house for large flocks particularly adapted to Georgia conditions is given, together with working drawings and a bill of materials.

**Getting water into the farm home**, V. OVERHOLT (*Ohio Agr. Col. Ext. Bul., 18 (1922–23), No. 14, pp. 16, figs. 13*).—Practical information on the installation of running water in farm houses is presented in this bulletin.



**Studies on the treatment and the disposal of dairy wastes**, C. L. WALKER ET AL. (*New York Cornell Sta. Bul.* 425 (1923), pp. 170, pls. 18, figs. 19).—Studies are reported to determine (1) methods that may be employed in successfully treating the various wastes developed in the dairy industry, and their relative value, (2) the necessary degree of dilution of the wastes untreated or partially treated to prevent the development of offensive conditions in streams and to prevent injury to fish life therein, and (3) the effect of the various wastes on fish life. Nine different experimental units were used, and the wastes studied included only fresh milk and whey.

It was found that natural processes tend to destroy these wastes and render them harmless in a manner similar to that in which they assist in the purification of other organic wastes, and that supplemental methods of purification are needed only when the amounts of waste present are in excess of those which nature can handle without the development of undesirable conditions. In certain instances the introduction of fresh milk wastes into a stream actually benefited the stream in that they stimulated the production of fish food. The amount of wastes which a stream can satisfactorily dispose of was found to depend upon the temperature of the stream, the rate and volume of stream flow, the character of the stream, and the types of plant and animal life present.

The investigations of supplemental methods of treatment showed that the rearing of bloodworms in large numbers for the direct consumption of milk wastes is possible, but that the difficulties attending the rearing of these larvæ render the results of waste treatment by them uncertain. The milk wastes were successfully treated by chemical precipitation with iron sulphate and lime. This treatment produced a clear, inoffensive effluent, and the precipitated material is said to contain considerable fertilizer constituents.

From 75 to 95 per cent of the organic nitrogen could be removed from whey by adding a slight excess of lime over that necessary to neutralize acidity, boiling, and then passing the cooled effluent through a septic tank and a sand filter. Such sand filter effluent was, however, even with a 95 per cent reduction of organic nitrogen, about two or three times as strong as a strong domestic sewage before treatment, and therefore could not be discharged into a small stream without danger of causing a nuisance, or of killing fish.

The activated sludge method of treating dairy wastes proved impracticable because of the large proportion of the offensive material in solution, the difficulty of developing sludge, and the difficulty and expense of operating such a plant where only small volumes of milk are handled and where the waste is discharged mainly in one or two hours.

A sand filter was found to purify milky waste septic tank effluents at rates ranging from 75,000 to 100,000 gal. per acre per day. A stone or more porous filter, such as a lath filter, could purify such effluents at rates ranging from 300,000 to 400,000 gal. per acre per day. These filters, however, did not give as high a degree of purification as the sand filter at one-fourth these rates.

Some form of settling and holding treatment for milk wastes was found desirable. Such treatment tended to reduce the total solids in suspension and the amount of organic nitrogen present, to decrease the loss on ignition of solids, and to render the wastes more alkaline. Settling and holding in an Imhoff tank were found undesirable, since the effluent from this tank is likely to clog filtering beds. The tank is also considered to be complicated and expensive to construct. Settling and holding in a septic tank are recommended,

since the tank is simple to construct and the effluent from it has less tendency to clog filtering beds.

It is concluded that septic tanks should be designed to hold from 1 to 3 days' flow of waste, and, since the waste generally enters in large volumes for a short interval of time, the period of retention is uncertain. The use of a grit chamber is recommended to intercept dirt, sawdust, or other inorganic matter contained in the wastes from a dairy plant. The use of porous beds of sand, stone, or other material to further purify the effluent from the septic tank is also recommended. These beds were found to treat the wastes at the same rate at which such filter beds would treat an average domestic sewage and therefore at the same cost.

Secondary sedimentation tanks are considered to be a necessary part of a treatment plant in which the filter material is coarse. The retention of the waste in such tanks need not exceed 10 minutes for the removal of more than 90 per cent of the settleable solids.

Whey was found to have a toxic effect on fish life, causing death in a few hours in dilutions as great as 1 volume of whey in 25 volumes of water. At 14° C. (57.2° F.), 1 volume of milk wastes to 15 volumes of water may or may not cause distress to fish, and as the temperature decreases the proportion of milk wastes to water may be increased. Fish showed little or no discomfort in a mixture of 1 volume of milk to 5 volumes of water when the temperature was below 12°. Fish would not live in water containing more than 0.75 lb. of Wyandotte, Goldenrod, or Perfection washing powders to 100 gal. of water.

Milk wastes before or after tank treatment may cause the death of fish through suffocation by using up the available oxygen in the water. Short-time experiments covering a period of 4 or 5 weeks indicated that concentrations as great as 1 volume of waste to 3 volumes of water, and in cold weather undiluted waste, would not cause the death of fish, including small-mouth black bass and brook trout.

Milk wastes could be so sufficiently purified by tank and filter treatment that fish showed no distress in the undiluted effluent. Fish did not seem to be much distressed when the dissolved oxygen content did not fall below 1.5 parts per million. The biochemical oxygen demand of milk wastes was found to vary with treatment, requiring from 0 to 30 volumes of water to 1 volume of waste. Allowing for absorption of oxygen from the air, this ratio may be considerably reduced.

A bibliography of 77 references to literature is included.

**Sulphur in sewage**, BACH (*Gsndhts. Ingen.*, 46 (1923), No. 38, pp. 370-377, fig. 1).—Studies are reported which showed that the sulphur content of domestic sewage and of other sewage contaminated with decaying organic matter is the primary cause of foul odors. It is concluded that technical processes for sewage purification must consider the condition of the sulphur content, and the necessity for extending sewage analyses to cover the nature of the sulphur compounds in the sewage and sludge is emphasized.

Simple processes for the removal of odors from sewage tanks by the introduction of materials which either absorb or destroy hydrogen sulphid are discussed.

## RURAL ECONOMICS AND SOCIOLOGY.

**Agricultural inquiry** (*U. S. Cong.*, 67. Cong., 1. Sess., *Hearings before Joint Comm. Agr. Inquiry*, 1921, pts. 1, pp. 69+I; 2, pp. 77+I; 3, pp. 32+I; 4, pp. 51+I; 5, pp. 68+III; 6, pp. 102+III, pl. 1; 6-A, pp. 16+I; 7, pp. 32+II; 8, pp. 69+II;



9, pp. 77+II; 10, pp. 55+I; 11, pp. 38+II; 12, pp. 22+I; 13, pp. 814+XVIII, figs. 39; 14, pp. 126+II; 15, pp. 88+II; 16, pp. 58+I; 17, pp. 42+I; 18, pp. 60+I, pl. 1; 19, pp. 52+I; 20, pp. 96+I; 21, pp. 230+III; 22, pp. 96+IV, pls. 3; 23, pp. 34).—The hearings before the Joint Commission of Agricultural Inquiry of the Sixty-seventh Congress, of which S. Anderson was chairman, are published in these pages. Farmers, representatives of farm organizations and of distributors and processors of farm products, officials connected with the Federal reserve system and other Government institutions, merchants, and bankers were heard.

**The agricultural crisis and its causes** (*U. S. House Represent., 67. Cong., 1. Sess., Rpt. 408, pt. 1 (1921), pp. 240, figs. 31*).—This is part 1 of the report of the Joint Commission of Agricultural Inquiry, submitted by S. Anderson, chairman. Hearings were conducted between July and November, 1921, for the purpose of investigating the causes of the present condition of agriculture and of the difference between the prices of agricultural products paid to the producer and the ultimate cost to the consumer; the comparative condition of industries other than agriculture; the relation of prices of commodities other than agricultural products to such products; the banking and financial resources and credits of the country, especially as affecting agricultural credits; and marketing and transportation facilities. The primary purpose of this report was to deal finally with the first of the major subjects, namely, the condition of agriculture and the factors that caused it, but it also considers to some extent the subjects of transportation and marketing and distribution.

The commission has undertaken to measure the well-being of the farmer by the purchasing power of the farmer's dollar, the absolute prices of farm products as compared with those of other groups of commodities, the quantity production of agriculture as compared with that of other industries, and the income or reward for capital invested and labor employed in agriculture as compared with that in other industries. It recommends (1) that the Federal Government affirmatively legalize the cooperative combination of farmers for the purpose of marketing, grading, sorting, processing, or distributing their products; (2) that the farmer's requirements for credit corresponding to his turnover and having maturity of from six months to three years, which will enable payment to be made from the proceeds of the farm, be met by an adaptation of the present banking system of the country, which will enable it to furnish credit of this character; (3) a warehousing system which will provide a uniform liability on the part of the warehousemen and in which the moral and financial hazards are fully insured; (4) prompt action by the railroads and constituted public authority to effect an immediate reduction of freight rates on farm products; (5) an extension of the statistical divisions of the U. S. Department of Agriculture, particularly along the lines of procurement of livestock statistics; (6) provision by Congress for agricultural attachés in the principal foreign countries producing and consuming agricultural products; (7) the development by trade associations and by State and Federal sanction of more accurate, uniform, and practical grades of agricultural products and standards of containers for the same; (8) adequate Federal appropriations for the promotion of better book and record keeping of the cost of production of farm products on the basis of the farm plant unit; (9) provision for an extended and coordinated program of practical and scientific investigation through State and National departments of agriculture and through agricultural colleges and universities; (10) more adequate whole-



sale terminal facilities, particularly for handling perishables at primary markets, and a more thorough organization of the agencies and facilities of distribution of the large consuming centers of the country; (11) the development of better roads to local markets, joint facilities at terminals connecting rail, water, and motor transport systems, and more adequate facilities at shipping points with a view to reducing the cost of marketing and distribution; and (12) greater effort for the improvement of community life. It believes that the renewal of conditions of confidence and of industrial, as well as agricultural, prosperity is dependent upon a readjustment of prices for commodities, to the end that prices received for them will represent a fair division of the economic rewards of industry, risk, management, and investment of capital.

**Credit** (*U. S. House Represent., 67. Cong., 1. Sess., Rpt. 408, pt. 2 (1922), pp. 159, pl. 1, figs. 21*).—Part 2 of the report noted above deals with the banking and financial resources and credits of the United States, especially as affecting agricultural credits. A detailed account of the Federal reserve system and an exposition of the fundamental principles underlying it and the banking machinery of the country are presented.

The commission holds that there is a gap between the short- and long-time credit furnished by existing banking agencies which can best be filled by adapting these agencies to the farmer's credit requirements. A system of intermediate credits through a separate department in the Federal land banks is outlined, and a bill along these lines is drafted.

In connection with the preparation of this report an analysis was made of reports to the Comptroller of the Currency and the Federal Reserve Board from about 9,500 banks throughout the country which are members of the Federal reserve system to ascertain what changes took place during the year ended April 28, 1921, in the loans of banks in agricultural communities as compared with the loans of banks in nonagricultural communities. All counties in the country were grouped as agricultural, semiagricultural, or nonagricultural, according to the value of their principal products. A report of this investigation is given here.

A minority opinion is added by O. L. Mills, taking exception to the statement that "a change in the policy of the Federal reserve system with reference to discount rates would have accomplished a reversal in part of the psychological and economic factors which at this time [i. e., late in 1920 and early in 1921] were moving in the direction of lower prices."

**Transportation** (*U. S. House Represent., 67. Cong., 1. Sess., Rpt. 408, pt. 3 (1922), pp. XIV+686, pls. 21, figs. 97*).—This is part 3 of the report of the Joint Commission of Agricultural Inquiry and is the work of the transportation division of the commission composed of numerous committees and subcommittees. The inquiry was divided into the major subjects of the economic relationship of agriculture, industry, and transportation; transportation by steam railroads; railroad management and organization; railway finance; railroad express companies; parcel post; electric railways, highway transportation; transportation by water, Federal and State regulation of transportation; foreign railway systems; and the history of railway transportation; and this report is presented on that basis. The data presented were assembled by means of questionnaires and conferences.

The commission reports in brief that the transportation rates, especially on the products of agriculture, bear a disproportionate relation to the prices of



such commodities. It recommends immediate reductions in transportation rates applied to farm products and other basic commodities and greater consideration by public rate-making authorities and by the railroads in the making of transportation rates to the relative value of commodities and existing and prospective economic conditions, as well as to the relationships between the price level and the level of transportation rates. The commission criticizes the pyramided percentage advances in rates, and holds that the railroads and the public rate-making bodies should seek to readjust rates back as far as practicable to the general relationship existing prior to 1918. It recommends further that the United States enter into immediate negotiations with the Dominion of Canada for the conclusion of a treaty for the improvement of the St. Lawrence River.

Suggestions are offered with reference to the standardization of freight equipment, the central control and distribution of freight cars, their repair, refrigeration, and better equipment in general, as well as with reference to terminal facilities and numerous other details of handling freight. A program of State and county highway construction and maintenance is also advocated.

**Marketing and distribution** (*U. S. House Represent., 67. Cong., 1. Sess., Rpt. 408, pt. 4 (1922), pp. IX+266, pls. 8, figs. 106*).—In view of the fact that fundamental data of a governmental or private character with reference to marketing and distribution were lacking, the Joint Commission of Agricultural Inquiry developed a special organization to secure the necessary information. A committee was set up in each trade or industry, and with their assistance questionnaires were worked out, 15,000 of which covering more than 200 commodities were sent out and returned. This part of the report of the agricultural commission is based upon the findings of the various committees. Chapters are devoted to the topics of marketing, grain, fruits and vegetables, wool, crop movement and markets, conversion or processing, wholesale distribution, retail distribution, total cost of distributing certain commodities, cooperative marketing, and the marketing and related activities in the Bureau of Agricultural Economics of the U. S. Department of Agriculture.

Recommendations are submitted in support of standardization in the production of crops; organization among producers for cooperative marketing; uniformity of grades and containers; the elimination of waste through the establishment of proper marketing agencies, warehouses, and other terminal facilities; the dissemination of information regarding consumers' demands; and other topics.

The last chapter was prepared by the U. S. Department of Agriculture.

**Weather, Crops, and Markets** (*U. S. Dept. Agr., Weather, Crops, and Markets, 4 (1923), Nos. 22, pp. 569-592, figs. 2; 23, pp. 593-616, figs. 4; 24, pp. 617-640, figs. 3; 25, pp. 641-664, figs. 2; 26, pp. 665-712, figs. 6*).—Tabulations and charts recording the temperature and precipitation in the United States during the weeks ended November 27 and December 4, 11, 18, and 25, 1923, are presented in these numbers, together with general and local summaries of weather conditions. The usual weekly and monthly reports with reference to the receipts and prices and the position in the market of important classes of crops and livestock and of specific commodities are given in each number. Among the crop reports which appear there is one in No. 22 summarizing data with regard to honey yields during the period 1913 to 1921. Tabulated statis-

ties showing tomatoes grown for manufacture, 1919-1923, are featured in No. 23. No. 25 presents some statistics of cotton production in 1922 and 1923 and of cotton prices, 1919-1922. The usual summary statistics of important crops are presented in No. 26, giving comparative figures for three years on 34 crops and the aggregate value of crops by States; United States average monthly prices of crops; current prices to producers, with comparisons; index numbers of prices; the average wages of farm labor by States for 1910, 1922, and 1923; and the December report on the acreage of winter wheat and rye sown in the fall of 1923.

**A farm account manual for New Jersey farmers**, H. KELLER, JR. (*New Jersey Stas. Circ. 160* (1923), pp. 31, figs. 32).—A set of directions is offered to farmers who have had no experience with bookkeeping. It describes the equipment required, the principles and the various steps involved in single entry bookkeeping, and the correct recording of transactions.

**The social areas of Otsego County**, D. SANDERSON and W. S. THOMPSON (*New York Cornell Sta. Bul. 422* (1923), pp. 3-40, pls. 3, figs. 6).—This study was undertaken as one of several investigations of the significance of the rural neighborhood as a social unit, arranged by C. J. Galpin, in which the Bureau of Agricultural Economics, U. S. D. A., is cooperating. An earlier one has been noted (*E. S. R.*, 46, p. 894). Various questionnaires were submitted through the district school teachers, and a county map of Otsego County, N. Y., was prepared showing the farm homes and school districts. The answers from 150 of these neighborhood questionnaires were tabulated, and the following facts were determined:

The neighborhoods averaged 12.5 homes and 2.25 square miles. The names of 71 neighborhoods were derived from families of early settlers or prominent persons, and the remainder were variously named from topographical features, nationalities, churches, mills, a post office, unknown sources, and miscellaneous. It is noted that there has been no change in their designation for an average of 87 years by 113 of the neighborhoods. The people joined together in neighborhood activities and socially in their homes to a considerable extent, also the men helped one another in their farm work. In regard to the question as to whether the schoolhouse was used for any neighborhood meetings, social evenings, public exercises, Sunday school, or any events other than school purposes, 26 replied that the neighborhood had no school or that it was closed and 95 reported that no such use was made of the school. Eight schools were used for Sunday school and church, 9 for Christmas and holiday entertainments, 5 for picnics at the close of school, 3 for school entertainments, 3 for occasional socials, and 3 were used occasionally. Of the 122 schools reporting, only 3 or 4 indicated that the school was making any definite effort to do more than the regular school work.

Brief descriptions are given of individual neighborhoods, and a classification is attempted of neighborhoods as the hamlet and institutional, business, ethnic, kinship, topographic, and village neighborhoods. In general it is concluded that the rural neighborhood in Otsego County is ceasing to function as a social unit except where it is likely to center in some local institution.

Another questionnaire was sent to each farm home, and to this about 1,500 replies were received. Community areas including school districts and high school areas; church parishes; bank, hardware, and freight areas; rural free delivery and telephone exchange areas; and possible school communities were determined and mapped.



**How farm tenants live**, J. A. DICKEY and E. C. BRANSON (*N. C. Univ. Ext. Bul.*, 2 (1922), No. 6, pp. 47, figs. 5).—Field studies in farm tenancy were made in the summer months of 1922 in compact areas of Edgecombe, Chatham, and Madison Counties, N. C. A preliminary report covering 329 farm homes in Baldwin and Williams townships of Chatham County is made in these pages. Of this number, 153 homes belonged to tenants, 51 of whom were white and 102 black. The property owned per family by 38 white renters amounted to \$526, that by 13 white croppers \$426, by 66 black renters \$409, and by 36 black croppers \$123. The average cash income of 135 white farm owners in this area was \$626, while that of the tenants ranged from \$153 for the white croppers to \$289 for the black renters. The average gross cash income for the 329 farmers was \$424 in 1921. Of the 51 white tenants, 25 were renters living on and cultivating family lands, 13 were, with one exception, the sons of landless tenant farmers, and 13 were transient croppers.

Practically no indication of overcrowding was found, but facilities for sanitation and medical care and school advantages were decidedly inadequate. The reading matter found in these homes, and the church and social affiliations are described.

**Child labor in North Dakota** (*U. S. Dept. Labor, Children's Bur. Pub. 129* (1923), pp. V+67, pls. 6).—This study covered the cities of Fargo, Grand Forks, and Minot, N. Dak., and six selected rural counties, including Pembina, where land values are high and potato production is important; Hettinger, where the soil is poorer and less adapted to the cultivation of crops than to stock raising; Pierce and Stutsman, representing the central sections of the State devoted largely to the cultivation of wheat; Logan, typical of territory in which the percentage of non-English speaking population is high; and Dickey, in which agricultural and social conditions are fairly typical of those in the southeastern part of the State. An inquiry into the extent and kinds of vacation work and employment before and after school was made by means of personal interviews with all children under 16 attending public schools in the three cities. In addition the establishments most likely to employ children were inspected in order to ascertain the extent of child employment, especially during school hours, and a brief inquiry was made into the methods of administering the laws affecting child labor. The investigation was planned and carried on under the general supervision of E. N. Matthews. The information with regard to rural child labor was analyzed by E. M. Springer, and that relating to the work of city children by H. A. Byrne and H. M. Dart.

A total of 113 selected rural schools were visited, in which 1,992 children between the ages of 6 and 17 were interviewed with regard to farm work. Detailed information was obtained from all children under 17 years of age who reported that they had lived on a farm during the year previous to the interview and carried on farm work for at least 12 days of 6 hours or more, or who, while attending school, customarily spent 3 hours or more a day at chores. A study was also made of the causes of absence from rural schools. Of 845 children between 6 and 17 years of age who had done farm work during the year covered by the study, all except 29 had worked in the fields. Seventy-one per cent of the children were under 14 years of age. Of 590 children reporting the duration of their field work, 22 per cent had worked 4 months or more during the year previous to the inquiry. The most important kind of farm work other than field work which was done was herding cattle, reported by 217, or 25.7 per cent of the children. One-fifth of the children (168 or 19.9 per cent) had worked away from home during the year previous to the interview, most of them having been engaged to help in harvesting. One hundred and four children had been injured while engaged in farm work.



In a study of the school records of 3,465 rural children in the 6 counties included in the study, the most important causes of absence from school were found to be illness, bad weather and bad roads, and work on farms or other work at home. Forty-two per cent of the 2,776 school children who were under 14 years of age and 59 per cent of those who were between the ages of 10 and 14 had stayed out of school for farm or home work, contrary to the State child labor law. Two-fifths of the 2,541 children who were between the ages of 8 and 17 were retarded 1 or more years. Boys left school at an earlier age than girls and in greater numbers and were more retarded in their school work, but the percentage of retardation for girls reporting farm work was the same as for boys reporting such work.

The last third of the report pertains to the employment of children in the cities. An appendix gives a classified list of accidents reported by 104 of the 845 children who had worked on the farms during 1921.

**Church life in the rural South**, E. DE S. BRUNNER (*New York: George H. Doran Co., 1923, pp. XV+17-177, figs. 35*).—Seventy counties in the States south of the Mason and Dixon line, with the exception of Virginia and Mississippi, were surveyed in a preliminary way for this one of The Town and Country Series (E. S. R., 48, p. 493). Later six of these counties were selected for resurvey, including Orange and Durham Counties in North Carolina, Monroe in Georgia, Colbert in Alabama, Blount in Tennessee, and Rockwall in Texas. An account is given here of the economic characteristics, the educational facilities and social life, and the religious situation, including the negro rural church.

Evangelism is held to be the keynote of the southern religious program. One great weakness in the religious organization is that the ministers remain with their churches for short periods only, and preaching has been regarded as the only function of the church. It is suggested, therefore, that in every parish a community program should be outlined which would give the church greater responsibility in regard to community problems, such as better roads, better housing and living conditions, better schools and agriculture, the care of the sick, the indigent, and the feeble-minded, and the elimination of vice. The effects of economic and social transitions make it incumbent upon the church to reach owners and tenants alike. Appendixes describe the methods used and give definitions. A brief list of recent books dealing with the rural South is also included.

### AGRICULTURAL EDUCATION.

**Rural education**, O. G. BRIM (*New York: Macmillan Co., 1923, pp. XXI+302*).—A résumé is given of the various points of view of rural education and of proposed purposes of the school as related to the children, the solution of adult and community problems, and nonrural social forces and organizations. The nature of "the good life" both from the standpoint of the individual and from the social point of view is set forth, as well as the measure to which the present rural situation satisfies its requirements. Chapters are given to the analysis of rural life as related to general social principles, adult growth and social progress, and the essential conditions of child growth.

It is held that the purpose of rural elementary education is the same as for elementary education anywhere, but that rural schools may be expected to differ from city schools in three ways, namely, the approach to study topics must be in terms of the rural environment; the reorganization, reconstruction, and transformation of the child's experience must be in terms of his immediate world; and the rural elementary school should be developed with specific



reference to the lacks or needs of rural life in general and of its own community in particular. Recommendations are then submitted with reference to the adaptations and applications of basic principles to the selection and method of various school subjects and their implication for the organization and community relations of the rural school. One chapter bears upon the preparation of the rural elementary teacher. An extensive bibliography is appended.

**The curriculum of the college of agriculture**, C. R. WOODWARD (*Ed. Rev.*, 67 (1924), No. 1, pp. 27-31).—It is here held that the agricultural college of today should train leaders, and that both the cultural and vocational aims must be given consideration in the curriculum. A study of the curricula of land grant colleges made by the New Jersey College of Agriculture at Rutgers and the report of the alumni course of study committee of the Massachusetts Agricultural College are noted in this connection. The conclusions of the two investigations are similar in that it is agreed in general that greater emphasis should be laid upon the courses in basic sciences and more time should be given to the liberal courses.

**A study of home economics education in teacher-training institutions for negroes**, C. A. LYFORD (*Fed. Bd. Vocat. Ed. Bul.* 79 (1923), pp. VII+124, figs. 8).—This report is presented in five parts relating, respectively, to vocational and educational needs of negro girls and women, a survey of teacher-training institutions for negroes, recommendations for home economics education in teacher-training institutions, dormitory life as a factor in home economics education, and regional and State home economics conferences.

In part 1 the public school facilities, home economics in land-grant institutions, agricultural and home economics extension work, the work of private industrial schools, private funds for negro education, and vocational education in home making are noted in setting forth the opportunities of negro girls and women. In part 2 a summary is given of observations made while on visits to many State schools, county training schools, and city and private schools, and specific recommendations are made. In discussing home economics departments, the author describes organization, teaching staff, and plant and equipment. Under home economics curriculum are noted the character of the course, standards for admission, attendance, type of students, class teaching, and outstanding needs.

Most of the State schools for negroes have been organized as boarding schools, and in all schools visited a majority of the students live within the school. The relation of problems of dormitory life to the courses in foods, household management, and laundry work is deemed an important phase of the education of the girls and women.

Part 5 presents observations and recommendations with regard to a number of regional and State conferences. The appendix gives an extensive list of textbooks and other publications relating to home economics.

**Agricultural evening schools**, J. A. LINKE ET AL. (*Fed. Bd. Vocat. Ed. Bul.* 89 (1923), pp. V+41, pl. 1).—This describes the possibilities in evening agricultural school work under the provisions of the Federal Vocational Education Act, and gives some account of a few of the different types of organization under way in certain States where effective work has been done. Some approved methods of establishing and conducting these schools for adult farmers are set forth. Among the topics discussed are organization and conduct, pupils, teachers, courses of study, methods of instruction, supervised practice, buildings, equipment, and the responsibilities, opportunities, and duties of possible cooperative agencies.

**Course of study in agriculture, 1923**, F. B. JENKS (*Vt. Bd. Ed. Bul. 1* (1923), *pt. 4*, *pp. 37*).—This publication constitutes part 4 of the manual and courses of study for the high schools of Vermont. The scope of the instruction described covers the last six grades of the public school course on a six and six plan, and is nonvocational, prevocational, and vocational in aim. The work of the first and second years is intended to be an introduction to general science and a general survey of the field of agriculture, with emphasis upon local problems. That of the third and fourth years is intended to be a definite, intensive study of farm problems, with emphasis on local needs. It is recommended that the work of the fifth and sixth years be vocational, and that an extensive farm project be a required part of the course.

**Course of study in home economics, 1923**, J. A. WINCHELL (*Vt. Bd. Ed. Bul. 1* (1923), *pt. 5*, *pp. 54*).—This is part 5 of the manual noted above. Outlines have been prepared setting forth the content and aims of courses in home economics, particularly in the junior high schools. An extensive list of suggested reference books is given, as well as lists of bulletins and periodicals.

**Insect life**, W. W. KRUEGER (*Grand Rapids: Central High School, 1923*, *pp. [3]+74*).—This is an elementary account.

**Suggestions for work in elementary agriculture.—Farm stock and dairying**, R. F. LUND (*Conn. Bd. Ed. Bul. 1* (1923-24), *pp. IV+110*, *figs. 34*).—The plan of a course in farm stock and dairying for grades 5 to 8 is presented, together with suggested steps in teaching procedure. Lessons are drawn up in exhibiting garden produce and farm stock and poultry, and in various classes of livestock, pastures, soiling crops, and dairy products. Suggested topics for compositions and public demonstrations and lists of supplementary reading farm papers, elementary texts, and animal breeders' associations are given.

**Pig raising for club members**, L. V. STARKEY (*Clemson Agr. Col. S. C., Ext. Bul. 58* (1923), *pp. 46*, *figs. 21*).—Questions and answers are drawn up in these pages covering the principal points to be presented to club members in the judging, care, and feeding of pigs.

## MISCELLANEOUS.

**Thirty-sixth Annual Report of the Pennsylvania Station, 1923**, [R. L. WATTS] (*Pennsylvania Sta. Bul. 181* (1923), *pp. 28*, *fig. 1*).—This bulletin discusses briefly the work of the station for the year ended June 30, 1923, including a financial statement for this period. The experimental work recorded is for the most part abstracted elsewhere in this issue.

**Quarterly Bulletin of the Michigan Experiment Station**, edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul., 6* (1923), *No. 2*, *pp. 41-78*, *figs. 10*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: Clover and Alfalfa Seed Movement, by C. R. Megee; When the Tractor Goes Down, by H. H. Musselman; White Grubs, by R. H. Pettit; and The Bacteriology of Ice Cream, by F. W. Fabian.



## NOTES.

---

**California University and Station.**—The fruit products laboratory has developed a product known as “jelly juice.” This consists of the juice of one or more kinds of fruits concentrated and blended in such a way that on adding the proper proportion of sugar and boiling for two minutes a jelly invariably results. The commercial preparation of this product has been taken up by several firms under various trade names, and the utilization of considerable cull fruit in this way is anticipated.

Four summer-session courses in subtropical horticulture will be offered this year for the first time. These courses will be given in the laboratories of the Citrus Experiment Station at Riverside, beginning June 28 and continuing until August 9. The purpose of the courses is primarily to furnish university students and teachers of agriculture an opportunity to obtain training in these subjects in a region where this type of horticulture is regularly pursued. The courses will be equivalent to courses of the same designation given in the college of agriculture at Berkeley and will yield equal university credit. They will present both the scientific and practical side of the subjects treated. The instruction will cover such subjects as propagation, planting, varieties, breeding, tillage, fertilization, pruning, diseases and injurious insects, picking, packing, and marketing.

H. J. Webber, professor of citriculture and director of the Citrus Experiment Station; C. M. Haring, professor of veterinary science and acting director of the station; M. E. Jaffa, professor of nutrition; E. B. Babcock, professor of genetics; F. M. Hayes, associate professor of veterinary science; and J. E. Dougherty, associate professor of poultry husbandry, have been granted a year's sabbatical leave of absence for travel and study. J. W. Nelson, associate professor of agricultural extension, has been granted a year's leave of absence to become secretary of the State Farm Bureau Federation, succeeding V. C. Bryant, who returned as assistant professor of agricultural extension January 1.

The resignations are noted of L. C. Holmes, assistant in agricultural extension, effective January 1, and S. S. Gossman, assistant in poultry husbandry at Davis, effective May 1. Sylvia L. Parker, associate in the department of biometry and vital statistics in the School of Hygiene and Public Health in Johns Hopkins University, has been appointed instructor in poultry husbandry, effective May 1, and Ada Robertson and H. D. Sylvester assistants in agricultural extension, effective January 1.

**Iowa College and Station.**—According to a note in *Iowa Agriculturist*, the department of poultry husbandry is soon to begin a series of breeding experiments covering a period of 4 years and including about 1,500 pullets. This work will necessitate the construction of additional poultry houses.

Investigations are also contemplated of ventilation in poultry houses in cooperation with the department of agricultural engineering, using houses completely sealed and supplied with a deficiency, a large excess, and intermediate amounts of air.

Homer G. Bryson, instructor in agricultural journalism, has resigned and has been succeeded by C. R. Smith.

**Massachusetts College and Station.**—Analysis has recently been made of the occupations of the graduates of the four-year course. Of the graduates of the last 20 years, approximately two-thirds are engaged in agricultural occupations and 21 per cent in some form of practical farming. Of the remainder, 43 per cent are employed in agricultural occupations other than farming, 18 per cent in business, and 18 per cent in other nonagricultural occupations. Of the 1,190 living graduates whose occupations are known, 79 are agricultural college administrators and teachers, 60 pursuing like work in agricultural schools, 27 station administrators and experts, 37 extension-service administrators and experts, 32 State agricultural experts, and 53 administrators and experts in the United States Department of Agriculture.

The Goessmann chemical laboratory, under construction at a cost of \$300,000, is nearing completion. It will have a frontage of 197 feet, with wings 70 by 90 feet deep, respectively. It will contain an auditorium seating 168, two lecture rooms seating 75 each, eight large laboratories and several small research laboratories, a departmental library, the Goessmann memorial alcove, and a seminary room. The chemical work of the college and station will be centered in the building, the station receiving a suite of rooms especially designed for research purposes.

The State appropriation for maintenance of the station has been increased from \$84,750 to \$94,000. This is exclusive of control work for which an additional \$31,100 has been appropriated.

H. F. Tompson resigned January 15 as professor of vegetable gardening and director of the Market Garden Field Station at Lexington in order to devote his full time to his own farm. R. M. Koon, in charge of horticultural work in soldier rehabilitation at the University of Delaware, has been appointed extension professor of vegetable gardening, beginning about February 1 and taking over the extension work in that subject. Victor A. Tiedjens has been appointed assistant research professor of vegetable gardening and William L. Doran assistant research professor of botany, both being located at the Market Garden Field Station.

Other appointments include Harold E. Wilson as laboratory assistant in pomology, Donald S. Lacroix as investigator at the Cranberry Substation, John P. Jones as assistant research professor of agronomy, and George B. Dalrymple as analyst in the fertilizer control service. Dr. Arao Itano has resigned as assistant professor of microbiology to take effect at the end of the present college year, when he will return to Japan to have charge of the division of microbiology and chemistry at the Ohara Institute for Agricultural Research. Charles O. Dunbar has resigned as investigator in chemistry.

President K. L. Butterfield has recently been elected a member of the International Institute of Sociology of Paris, of which M. Georges Clemenceau is chairman.

**Conference of Negro Land-Grant College Presidents.**—This organization, which has succeeded the Association of Negro Land-Grant Colleges formed at Tuskegee Normal and Industrial Institute in 1923, held its first meeting at Hampton Normal and Industrial Institute March 3-5. The meeting was called by the United States Commissioner of Education, and the Federal Board for Vocational Education and the United States Department of Agriculture cooperated in the program. The special object of the meeting was to aid the member colleges in strengthening their courses in agriculture, home economics, and trades and industries. Progress is reported in planning



a standard course in agriculture for negro colleges, and work will be continued by committees with the cooperation of this Department, the Bureau of Education, and the Federal Board for Vocational Education. President J. M. Gandy, of the Virginia Normal and Industrial Institute, was reelected president of the conference.

**Imperial College of Tropical Agriculture.**—The personnel of the scientific staff of this college, which was formally opened at St. Augustine, Trinidad, in October, 1922, consists of Sir Francis Watts, principal; H. A. Ballou, professor of zoology and entomology; S. F. Ashby, professor of mycology and bacteriology; S. C. Harland, professor of botany and genetics; F. Hardy, professor of chemistry and soil science; J. S. Dash, professor of agriculture; W. R. Dunlop, professor of economics; and E. C. Freeland, professor of sugar technology. There are also several administrators and lecturers. A three-year diploma course is being given in general agriculture, and facilities are also provided for graduate work in various lines of tropical agriculture.

The college is establishing a model sugar factory, for which British sugar machinery manufacturers are contributing equipment valued at £20,000. The factory is expected to be completed next year.

The Colonial Research Committee of the British Empire has made a special grant to the college toward the expenses of carrying on investigations of the Panama disease of bananas.

*Tropical Agriculture* is being published monthly by the college. The initial number consists mainly of numerous short articles by various members of the college staff and others.

**Phytopathological Service for France.**—The establishment of such a service is provided by a decree dated November 24, 1923. The service is charged with general oversight of conditions pertaining to plant production; the control of invasions of insect, fungus, and other injurious plant pests; inspection of nurseries and fields of those engaged in the export business; and the issuance of certificates of inspection.

**Agricultural Institute at Lin I Hsien, Shantung, China.**—An account has been received of an agricultural institute which was held in April, 1923, at Lin I Hsien, a market town about 50 miles north of Tsinan, under the auspices of the Tsinan Station Shantung Mission and the College of Agriculture and Forestry of the University of Nanking. Members of the staff of the college, students, and other visiting lecturers spent four days presenting the value of improved cotton strains, better methods of cotton cultivation, and soil improvement; exhibiting improved farm crops material; demonstrating an American plow; and giving plays in the local theater on themes relating to agricultural improvement and social betterment. The exhibits were arranged in the local Taoist Temple. The magistrate of the district cooperated in the financial support and arrangements for the institute.

The institute is said to have been the first in the region and attracted great attention. At one evening session several thousand people attended an illustrated lecture on the cultivation and fertilization of soils. It was hoped to repeat the institute in the fall.

The missionary in charge had become convinced through his famine relief work that Christianity must be made more practical in its expression to the country people, that famines would continue until better economic and social conditions prevailed as well as an altered spiritual life, and that the development of a self-respecting and self-supporting land depended on this.

**Necrology.**—The death of Dr. T. Wurth, director of the Malang Experiment Station in the Dutch East Indies, has recently been reported.

Dr. Wurth, after a connection with the station for two years, was appointed director in 1911. Under his leadership the station developed in equipment as well as in its capacity to meet the demands of the associations of planters and others interested in the production of coffee, rubber, and other tropical crops and products. A new station building, in the construction of which he was largely concerned, was dedicated only a few months before his death.

Dr. Wurth published many articles in agricultural and scientific journals on the culture, improvement, and diseases of coffee and rubber.

**New Journals.**—*Cereal Chemistry* is being published bimonthly by the American Association of Cereal Chemists, which in 1923 united with the American Society of Milling and Baking Technology under the name of the former organization. The editorial staff includes Dr. C. H. Bailey of the Minnesota University and Station as editor in chief. The contents of the initial number are as follows: *Cereal Chemistry of To-day*, by M. J. Blish; *A Viscosimetric Study of Wheat Starches*, by O. S. Rask and C. L. Alsberg; *Characteristics of the 1923 Hard Winter Wheat Crop*, by R. S. Herman and A. R. Sasse; *Abstract of the Report of Referee on Cereal Foods*, Association of Official Agricultural Chemists, by C. E. Mangels; *The Physico-chemical Properties of Strong and Weak Flours—VIII*, *Effect of Yeast Fermentation on Imbibitional Properties of Gluten*, by P. F. Sharp and R. A. Gortner; and *Physical Tests of Flour Quality with the Chopin Extensimeter*, by C. H. Bailey and A. M. LeVesconte.

The *British Journal of Experimental Biology* is being published quarterly by the animal breeding research department of the University of Edinburgh with F. A. E. Crew as managing editor and an editorial board from several other institutions. It is the intention to publish original contributions in genetics, experimental embryology, comparative physiology, and histological, cytological, or morphological subjects having a direct bearing on problems of experimental interest. The initial number contains the following articles: *Studies on Internal Secretion.—II*, *Endocrine Activity in Fetal and Embryonic Life*, by L. T. Hogben and F. A. E. Crew; *Studies on the Comparative Physiology of Digestion.—I*, *The Mechanism of Feeding, Digestion, and Assimilation in the Lamellibranch Mya*, by C. M. Yonge; *Parthenogenesis in the Mollusk *Paludetrina jenkinsi**, I, by G. C. Robson; *Further Data on Linkage in *Gammarus chevreuxi* and its Relation to Cytology*, by V. S. Huxley; *Histological Studies on the Gonads of the Fowl.—I*, *The Histological Basis of Sex Reversal*, by H. B. Fell; and *Tissue Culture: A Critical Summary*, by H. M. Carleton. Announcement is also made of a proposal to organize a British association of experimental biologists.

The *Potato News Bulletin* is being issued monthly by the Potato Association of America. The initial number contains notes on the status of the potato crop in various localities and brief abstracts of recent literature.

---

ADDITIONAL COPIES  
OF THIS PUBLICATION MAY BE PROCURED FROM  
THE SUPERINTENDENT OF DOCUMENTS  
GOVERNMENT PRINTING OFFICE  
WASHINGTON, D. C.  
AT  
5 CENTS PER COPY  
SUBSCRIPTION PRICE, 75 CENTS PER YEAR



# EXPERIMENT STATION RECORD.

VOL. 50.

ABSTRACT NUMBER.

No. 6.

## RECENT WORK IN AGRICULTURAL SCIENCE.

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

**Suitability of various solvents for extracting vanilla beans,** I. J. B. WILSON and J. W. SALE (*Indus. and Engin. Chem.*, 15 (1923), No. 8, pp. 782-784).—A comparison is reported from the Bureau of Chemistry, U. S. D. A., of the amount and nature of the extracts prepared from Mexican, Bourbon, and Tahiti vanilla beans and from tonka beans by various substitutes for ethyl alcohol, including isopropyl alcohol, ether, acetone, and carbon tetrachlorid. As standards for comparison, the analytical characteristics of extracts made with 65 and 95 per cent ethyl alcohol and with alkaline 65 per cent ethyl alcohol were used.

From the standpoint of yield of extractive matter soluble in 65 per cent alcohol, the vanilla beans were rated in decreasing order as Bourbon, Tahiti, and Mexican. The total extractive matter obtained with acetone was less than with the alcoholic solvents, but substantially more than that obtained with ether and carbon tetrachlorid. With tonka beans, the amount of extractive matter soluble in 65 per cent alcohol was also less in the case of the solvents other than alcohol. It is noted, however, that carbon tetrachlorid extracted from all the beans substantial amounts of a viscous tasteless material insoluble in 65 per cent alcohol. It is thought that on subjecting the beans to a preliminary extraction with carbon tetrachlorid, the removal of this insoluble substance will make it possible to use more dilute solutions of alcohol for subsequent extraction of the flavoring matter.

**A chemical and structural study of mesquite, carob, and honey locust beans,** G. P. WALTON (*U. S. Dept. Agr. Bul.* 1194 (1923), pp. 20, pls. 2).—In an effort to promote the utilization of mesquite beans, great quantities of which go to waste in the United States, the literature on the use of these beans as a feeding stuff has been reviewed, and analyses have been made of the whole fruit and of various parts separated by hand and by mechanical means. Since the pericarp or pod contains nearly all of the sugar and crude fiber and the seeds most of the protein and fat, it was thought that a better utilization could be effected by separating the fruit into these constituent parts. A further reason for such separation was that the seeds as present in the whole fruit pass almost unchanged through the digestive tract of animals consuming them and must, therefore, be ground to become available. Great difficulty has been experienced in grinding the whole pod on account of the tendency of the sticky material of the pod to clog the mill.

The method of separation that proved most practical was essentially as follows: The pods were dried in the air and then in a vacuum oven at 65° C.

The dried pods were broken in a coffee mill in such a way as not to rupture the seed capsule, and the resulting material was shaken in a 3-mm. sieve which allowed only pod and sugary material to pass, but left some of the latter adhering to the seeds. This was removed by grinding the seeds again in the coffee mill with the burrs set about 4 mm. apart. The material was again sieved and the portion passing through added to the pod material. The burrs of the coffee mill were set a little closer (from 2.4 to 3.2 mm. apart) and the seed capsules ground slowly through the mill, the operation being repeated. A further separation was effected by the use of a 3-mm. sieve, the small seeds passing through being classed as seconds and those remaining as first grade. The first grade seeds were separated from the broken husks by the use of a grain and bean cleaner and, after being tempered by standing overnight in 5 per cent of their weight of water, were broken in the coffee mill, ground in a pestle, and rubbed through 20-mesh and 40-mesh sieves.

Some of the data obtained in the analysis of the various products are summarized in the following table:

*Composition of mesquite beans (moisture-free basis).*

Material analyzed.	Crude protein (N×6.25).	Ether extract.	N-free extract.	Crude fiber.	Ash.
	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Entire fruit, average of 14 samples.....	13.00	2.50	52.50	27.40	4.60
Entire pericarp (sugary pod and seed capsule portion), average of 9 samples.....	6.68	1.00	56.51	31.30	4.51
Entire seeds, average of 9 samples.....	36.27	4.90	47.23	7.53	4.67
Portions separated by mechanical means:					
Pod and sugary material.....	10.10	2.27	53.52	30.04	4.07
Seed capsules or husks.....	4.34	.60	37.29	54.33	3.44
Seed coats.....	7.70	.65	77.34	12.04	2.27
Seed kernels.....	65.17	7.76	19.10	2.80	5.17

Data were also obtained on the distribution of carbohydrates in the various samples analyzed. The pods contained about 20 per cent of sucrose. The seed coat material, which yielded almost no sucrose, contained over 14 per cent of pentosans, 20 per cent of galactans, and nearly 35 per cent of other readily hydrolyzable carbohydrates. Analyses of water extracts of various mesquite-bean products gave yields as high as about 57 per cent of sucrose, thus showing possibilities in the way of sugar manufacture.

The seeds of the honey locust were also analyzed, and found to contain less protein than the mesquite seeds, but the whole fruit contained more protein and less crude fiber than the whole mesquite beans. Carob pods contained more sugar and less crude fiber than honey locust pods, and the whole fruit contained from one-third to one-half as much crude protein as either the honey locust or the mesquite.

A list of 27 literature references is appended.

**Physico-chemical studies of strong and weak flours.**—II, The imbibitional properties of the glutes from strong and weak flours, P. F. SHARP and R. A. GORTNER (*Jour. Phys. Chem.*, 26 (1922), No. 2, pp. 101-136, figs. 7).—The studies reported in this and the following four papers were undertaken to test the hypothesis advanced in the first paper of the series (*E. S. R.*, 39, p. 468), that "the difference between a strong and weak gluten is apparently that between a nearly perfect colloidal gel with highly pronounced physico-chemical properties, such as pertain to emulsoids, and that of a colloidal gel in which these properties are much less marked. It is suggested that such



differences may be due to the size of the gluten particles, and that at least a part of the particles comprising the weak gluten may lie nearer the boundary between the colloidal and crystalloidal states of matter than is the case with the stronger glutens."

As none of the flours used in the previous study were available, it became necessary to repeat part of the work with the new samples to be used. In the present paper are reported data on the hydration or imbibitional properties of the new samples of flour. These included a strong patent flour milled from northern spring wheat, a first clear flour made in the same mill, and two patent flours milled from soft wheat. Flour analyses and baking tests are reported for these flours and in addition the imbibitional properties of the flours in the presence of different strengths of lactic and hydrochloric acids, and of potassium, sodium, calcium, barium, and ammonium hydroxids; the effect of  $M/200$  sodium sulphate on the rate of imbibition in solutions of potassium and calcium hydroxids; and the optimum H-ion concentration for the swelling of discs in lactic, acetic, o-phosphoric, hydrochloric, and oxalic acids.

The rate of imbibition of the flours in the different acids and bases was much higher in the case of the strong than of the weak flours. Dispersion took place more rapidly and at a lower concentration with the alkalis than with the acids. The addition of sodium sulphate to potassium and calcium hydroxid lowered the imbibitional rate to a marked extent. Drying the glutens washed from the different flours in a vacuum oven at from 45 to 50° C. altered their physico-chemical properties to the extent of making them more nearly alike.

"All of the data in the present paper confirm the postulation of Gortner and Doherty that a weak flour which owes its inferior strength to the quality of its gluten is weak because of the fact that its gluten possesses markedly inferior colloidal properties and is not so perfect a colloidal gel as is the gluten of a strong flour."

**The physico-chemical properties of strong and weak flours.—III–VI,** (*Jour. Phys. Chem.*, 27 (1923), Nos. 5, pp. 481–492, figs. 4; 6, pp. 567–576, figs. 5; 7, pp. 674–684, fig. 1; 8, pp. 771–788, figs. 6).—In continuation of the above investigation, four papers are presented.

III. *Viscosity as a measure of hydration capacity and the relation of the H-ion concentration to imbibition in the different acids*, R. A. Gortner and P. F. Sharp (pp. 481–492).—The viscosity of flour-in-water suspensions was studied to determine the suitability of this as a method of determining the imbibitional properties of the flour proteins as affected by acids. The moisture in the flour was first determined, and to the calculated amount of flour required to make 25 gm. on the dry basis sufficient water was added to furnish a total of 100 gm. of water. The mixture was allowed to stand for one hour, with frequent shaking, in a room at a constant temperature of 25° C., after which the viscosity of 100 cc. of the mixture was determined with a MacMichael viscosimeter of the original type. Normal solutions of the various acids were then added in increasing amounts up to 10 cc. of  $N$  acid, and quadruplicate readings of the viscosity made after each addition. The H-ion concentration was determined electrometrically on 20 cc. aliquots of the flour-in-water suspension to which had been added the proportionate amount of acid to correspond with the various points on the imbibition curve.

The viscosity readings showed marked differences in the imbibitional capacity of the gluten colloids from the strong and weak flours. With the different acids the same maximum was not reached nor was the order the same with the

two flours. The curves obtained by plotting the imbibitional data against the pH of the mixture were all similar in shape and tended to reach a maximum at a pH of 3. Lactic acid brought about the least change in viscosity per unit of actual acid concentration, and is thought to be best suited for the measurement of the imbibitional capacity by the viscosity method.

IV. *The influence of the ash of flours upon the viscosity of flour-in-water suspensions*, Gortner and Sharp, pp. 567-576.—Using the methods of the previous study, the effect was determined of the presence of salts upon the measurement of the viscosity of flour-in-water suspensions. In each experiment the equivalent of 25 gm. of flour on the moisture-free basis was treated with enough water and salt solution to make 100 gm. of N/100 salt solution, and the viscosity changes caused by the addition of various amounts of normal lactic acid were determined.

With both types of flour the salts fell into two groups with respect to their effect on imbibition. In increasing order these were  $MgCl_2$ ,  $NaCl$ , and  $K_2HPO_4$  in the group showing the least effect and  $MgSO_4$ ,  $K_2SO_4$  and  $CaCl_2$  in the group showing the greatest effect. This indicates that the depressing effect was not caused solely by the anion or the cation, nor by the valency of each.

To determine the effect of the soluble electrolytes present in the flour itself, these were removed by leaching with water, and the resulting ash-free residue was treated with various amounts of different acids. With the extracted flours a much smaller amount of acid produced a marked increase in imbibition as compared with the nonextracted flours, and the action of the different monobasic acids was more nearly the same. The maximum imbibition was again reached at a pH of approximately 3.

The maximum imbibition obtained with sodium and barium hydroxids occurred at a pH of approximately 11. The electrolytes present in the original flour did not have so great an inhibiting effect in the presence of alkalis as of acids.

It is suggested that the imbibition in alkalis may prove a more valuable method of studying the flour strength than will imbibition in acids. If acids are used the determination of the viscosity of suspensions of flour in water from which the soluble ash has been removed previously is thought to represent more nearly the true imbibitional powers of the proteins present in the flour.

V. *The identity of the gluten protein responsible for the changes in hydration capacity produced by acids*, Sharp and Gortner, pp. 674-684.—Evidence is presented that on removing the alcohol-soluble protein gliadin from flour by extraction with water the resulting increase in imbibition produced by 0.1 cc. of lactic acid on the residue in suspension was very marked and practically instantaneous. On extracting the gliadin with alcohol, the residue again showed an increase in viscosity but not to so marked an extent. These results are thought to indicate that glutenin is the protein mainly responsible for the increase in imbibition, but that in the case of the alcohol-treated flour the lower viscosity is due to the denaturizing effect of the 70 per cent alcohol on the glutenin. Attention is called to similar conclusions drawn by Woodman from entirely different evidence (E. S. R., 49, p. 308).

"A 'strong' flour is apparently characterized by the presence of a glutenin possessing marked colloidal properties, whereas the corresponding colloidal properties of the glutenin in a weak flour are much less pronounced."

VI. *The relation between the maximum viscosity obtainable by the addition of lactic acid and the concentration of flour-in-water suspensions*, Sharp and Gortner, pp. 771-788.—This paper reports a comparison of the glutenin content with viscosity and loaf volume of the series of 11 flours used in previous studies by Collatz and Rumsey (E. S. R., 49, p. 12).



The Official method of determining glutenin by subtracting from the total protein content the sum of the alcohol-soluble protein and the potassium sulphate-soluble protein on separate samples of flour was considered to give too low results, due to overlapping solubility. It is thought that a more accurate determination can be made by subtracting from the total protein content of the flour the sum of the amounts of protein extracted by 5 per cent potassium sulphate solution, followed by extraction with 70 per cent alcohol.

In the flours examined the gliadin and glutenin were present in approximately equal amounts. To determine the effect of concentration on the maximum viscosity produced by the addition of various amounts of acids, the imbibition by 2 cc. of sirupy lactic acid of suspensions of different concentrations was tested. It was found that if the logarithms of the maximum viscosity readings were plotted against the logarithms of the flour concentration the points fell in a straight line according to the equation

$$\text{Log of viscosity} = a + b (\text{log of concentration}).$$

In this equation  $a$  is the logarithm of the viscosity readings when the logarithm of the concentration is zero and  $b$  is the tangent of the angle made by the logarithmic curve with the axis of the abscissa. These constants have been calculated for the various flours used. The values for the constant  $b$  were higher for the series with the electrolytes present than for the series with the electrolytes removed.

The constant  $K$  obtained by dividing the product of the glutenin concentration and the constant  $b$  by the loaf volume showed considerable fluctuation with the electrolytes present. When the electrolytes were removed the constants fell into three groups, the first consisting of patent or straight flours suitable for bread making, the second of pastry flours, and the third of clear flours.

"A relation between the quantity of glutenin, the quality of the glutenin as indicated by the constant  $b$  of the logarithmic equation, and the loaf volume, is indicated for the flours studied. Flour strength, in so far as the colloidal properties of the gluten are concerned, is apparently dependent upon the quality of the glutenin. A numerical value for glutenin quality is given in the constant  $b$  of the logarithmic equation."

**Some research problems in the carbohydrates, J. C. IRVINE** (*Brit. Assoc. Adv. Sci. Rpt.*, 90 (1922), pp. 33-48).—This address deals principally with researches conducted in the author's laboratory on the constitution of cellulose, starch, synthetic dextrans, and inulin.

**The chemical properties of cotton linters, W. F. HENDERSON** (*Indus. and Engin. Chem.*, 15 (1923), No. 8, pp. 819-822, figs. 3).—This paper reports a study of the physical characteristics, analytical constants, and important chemical reactions of cotton linters, the investigation being undertaken with a view to suggesting new uses of linters.

The analytical constants reported are moisture 5.5, extracted material from 0.31 to 0.57, ash 0.13, and copper reduction 0.57 per cent. On treating linters with strong acids, it was found that the copper numbers were increased very rapidly when the acid concentrations were high. With weak acids the change in copper numbers was insignificant for all concentrations, and with alkalis the copper numbers remained practically constant.

A particular study was made of the esterification of linters, particularly the production of benzoate and of dithiocarbonate, or viscose. The preparation of the latter is described in detail.

**Furfural from corncobs.—II, The Bureau of Chemistry experimental plant and process for furfural production, F. B. LaFORGE and G. H. MAINS**

(*Indus. and Engin. Chem.*, 15 (1923), No. 8, pp. 823-829, figs. 4).—Continuing previous work (E. S. R., 49, p. 507), a detailed description is given of the experimental plant established by the Bureau of Chemistry, U. S. D. A., for the manufacture of furfural from corncobs and of the details of the process.

It is considered that the process as devised is commercially feasible, not only for corncobs but for other pentosan-containing vegetable wastes, such as oat hulls, rice hulls, bagasse, etc.

**Extraction of vitamins from yeast and rice polishings with various water-miscible solvents**, C. FUNK, B. HARROW, and J. B. PATON (*Jour. Biol. Chem.*, 57 (1923), No. 1, pp. 153-162).—In this study of the relative value of different water-miscible solvents for the vitamins of yeast and rice polishings, the extractions were carried out under uniform conditions and the various extracts and residues tested as sources of vitamin B for rats and pigeons. The extracts were also tested for vitamin D in yeast growth experiments by the method of Funk and Dubin (E. S. R., 44, p. 861) and for coferment by the method of Harden, Thompson, and Young (E. S. R., 25, p. 9). Determinations were also made of the content of nitrogen and total solids in the extracts calculated to dry basis. The solvents tested with yeast included methyl, ethyl, propyl, butyl, and isobutyl alcohols in varying strengths from 50 to 80 per cent and acetone, methyl-ethyl ketone, and acetic acid in 70 per cent concentration. For the rice polishings ethyl alcohol in 50, 60, and 70 per cent concentration and propyl alcohol and acetone in 70 per cent concentration were used. The results obtained are presented in tabular form, the effect of the extracts and residues on pigeons and rats being given as the average gain or loss in weight per kilogram of body weight per day. The experiments in general ran for about eight days.

In discussing the results obtained, two criteria of vitamin activity are taken. In one the standard selected is that not only must the extract be active, but the residues must be inactive. In the other the inactivity of the residue is considered secondary to the amount of nitrogenous impurities accompanying the extract. As judged by the first criterion, 70 per cent alcohol would be considered the best solvent for the yeast vitamin and by the second, 70 per cent acetone. For rice polishings 60 per cent alcohol proved better than 70 per cent, and acetone extracts proved unsatisfactory for pigeons but satisfactory for rats. In general the higher the content of vitamin B the higher was that of vitamin D, but no relation was found to exist between coferment and either vitamin B or D.

**A color test for water-soluble B**, A. JENDRASSIK (*Jour. Biol. Chem.*, 57 (1923), No. 1, pp. 129-138, figs. 2).—In an effort to find a test which is characteristic of vitamin B, extracts were made with various solvents for vitamin B of several kinds of vegetable food materials botanically unrelated but all containing this vitamin. Similar extracts of the same materials were made with solvents which are known not to have the property of dissolving vitamin B. Finally extracts were made with solvents which do and do not dissolve materials known not to contain vitamin B. The various extracts were then subjected to different tests in the hope that some test might be positive for all the extracts containing vitamin B and negative for all those not containing this vitamin. It is reported that such requirements are fulfilled by ferric ferri-cyanid, which formed a blue color with all extracts containing vitamin B and gave negative results with extracts free from this vitamin. The technique for the test is described as follows:

“To the concentrated aqueous solution of the preparation in question acetic acid is added to make the concentration about 2 per cent. The reagent is



freshly prepared by mixing equal volumes of tenth molar ferric chlorid and potassium ferricyanid solutions. The reagent is added as long as the depth of the blue color increases. The test tube containing the mixture is stoppered and allowed to stand 10 minutes, when the color is observed. One to 5 volumes of distilled water are added to reach a convenient dilution and the color is again observed. If there is not a distinct blue color, or after standing for some time a bright blue precipitate, the test is negative."

It is pointed out that this test is in harmony with the observations of Abderhalden (E. S. R., 47, p. 859) and of Hess (E. S. R., 47, p. 862) that tissues possess a greater oxygen absorption capacity when derived from pigeons supplied with vitamin B than from those fed solely on polished rice.

**A new biochemical method for the determination of the viability of seeds,** A. NĚMEC and F. DUCHOŇ (*Ann. Sci. Agron. Franç. et Étrangère*, 40 (1923), No. 3, pp. 121-150, figs. 8).—The method described depends upon the theory that the viability of a seed is proportional to its catalase content.

**The application of the quinhydrone electrode to electrometric acid-base titrations in the presence of air, and the factors limiting its use in alkaline solution,** V. K. LA MER and T. R. PARSONS (*Jour. Biol. Chem.*, 57 (1923), No. 2, pp. 613-631, fig. 1).—A comparison is reported of the values obtained in the electrometric titration of hydrochloric, acetic, and boric acids and potassium acid phosphate, all of M/5 concentration, with sodium hydroxid, using benzoquinhydrone and hydrogen electrodes, respectively.

Reliable results were obtained with the benzoquinhydrone electrode in buffered solutions more acid than pH 8, but not in alkaline solutions. The various causes leading to incorrect results in the alkaline solutions are discussed with reference to their relative importance. It is concluded that the "benzoquinhydrone electrode can be substituted for the hydrogen electrode as a more simple and more rapid way of accurately determining the titration end points of acids (but not bases) that are stronger than the secondary ionization constant of phosphoric acid."

**Further notes on the estimation of potassium by the perchlorate and cobaltinitrite methods, and on the removal of sulphates,** R. L. MORRIS (*Analyst*, 48 (1923), No. 567, pp. 250-260).—This paper includes a further discussion of the perchlorate method of determining potassium (E. S. R., 45, p. 314), with directions for its application when the phosphates of the alkaline earth metals are present and for the removal of the sulphate ion by a procedure which is said to reduce considerably the loss of potassium in the usual barium sulphate method. Various modifications of the cobaltic nitrite method are also discussed.

**A modified test for phthalates, with particular reference to the detection of diethylphthalate,** R. E. ANDREW (*Indus. and Engin. Chem.*, 15 (1923), No. 8, p. 838).—A modified test for the detection of diethylphthalate used as a denaturant of ethyl alcohol in toilet preparations has been devised at the Connecticut State Experiment Station. The technique of the method is as follows:

"To 10 cc. of the solution to be tested in a small porcelain capsule add 5 drops of a 10 per cent sodium hydroxid solution. Evaporate over a steam bath to dryness and then add 0.5 cc. of a 5 per cent resorcin solution and again evaporate to dryness. Remove from the steam bath and at once add 6 drops of concentrated sulphuric acid and mix thoroughly by rotating the capsule. When cool add 10 cc. of water and transfer to a test tube, rinsing the capsule with 10 cc. of water. Add 5 cc. of a 10 per cent sodium hydroxid solution. A green fluorescence will at once appear if the test is positive, the

color of the fluorescence varying from green to yellow-green, according to the amount of phthalate present."

**The relation of alcohol precipitate to jellying power of citrus pectin extracts,** R. JOHNSTIN and M. C. DENTON (*Indus. and Engin. Chem.*, 15 (1923), No. 8, pp. 778-780).—This investigation, conducted at the Office of Home Economics, U. S. D. A., deals with the preparation of pectin extracts from citrus peel, and a comparison of the jellying power of these extracts with the pectin content as determined by the alcohol precipitation method.

The pectin solutions were prepared in the open kettle and in the autoclave, with and without the addition of alcohol. The open-kettle process consisted in extracting 226.7 gm. of ground white peel (orange) three times with a liter of distilled water. The heating was carried on in shallow pans in which a concentration to about one-half the original volume took place in 20 minutes, the extract then being filtered through cloth. In the autoclave three extractions were made with 330 cc. of water each time, using the same amount of peel as in the open kettle process. Pressures of from 3 to 20 lbs. and times of from 10 to 40 minutes were used. A similar series of extracts was prepared using N/10 citric acid in place of distilled water.

The pectin content of all the extracts was determined by the alcohol precipitation method and indirectly by the measurement of jellying power. For this measurement from 4 to 6 jellies were made with each pectin solution, using 84 gm. of sugar, amounts of pectin extract ranging from 20 to 80 gm., enough N citric acid to bring the total acidity to 1.3 gm., and distilled water to bring the volume to 150 cc. This mixture was concentrated by boiling to 104° C. and poured into molds 1.25 in. deep and 2.75 in. in diameter. The arbitrary standard selected for comparison was a gel barely stiff enough to retain its shape when removed from the mold. In each series the jelly corresponding to this standard was selected, and the amount of pectin extract used was taken as a measure of the jellying power of the extract.

No agreement was found between the figures thus obtained and the results of the alcohol precipitation test. The extracts prepared in the autoclave gave much higher results in the alcohol precipitation test, but were decidedly inferior in jellying properties. It is thought that at the higher temperature of the autoclave the pectin bodies are decomposed, and that the alcohol precipitate in this case consists chiefly of partially decomposed pectins, pectic acid, and possibly some hemicelluloses which do not contribute to the jellying properties.

The addition of acid increased both the alcohol precipitate and the jellying power, though not in the same proportions. The effect of the acid was more pronounced with the orange than with the lemon peel. This is thought to be due to a difference in kind rather than in amount of pectin present.

"The true explanation for the discrepancies which have been pointed out involves a knowledge of the pectin bodies both as regards their constitution and their colloidal nature, which at present is not available.

"As a result of unfinished tests with purified pectins, the writers concluded that quantitative relations in sugar-pectin-acid gels can not be correctly interpreted, nor can any great advance be made in the study of the colloidal properties of these solutions until there are available for careful experimentation pectins of a high degree of purity and of well-defined composition.

"When the relation of jellying power to composition is once established, a very satisfactory method of estimating effective pectin content, based upon jellying power, can be developed. Such a method, to be capable of general application, will require an accurate device for measuring gel strength under carefully standardized conditions."



**Jellying of sorghum sirup.**—Effect of malt diastase upon the filtration of sorghum juice, S. F. SHERWOOD (*Indus. and Engin. Chem.*, 15 (1923), No. 8, pp. 780-782, figs. 2).—It has been possible to prevent the jellying of sorgho sirup by a preliminary treatment of the juice with malt diastase. This increases the rate of filtration, prevents the formation of scum on boiling, and does not alter the taste or flavor of the sirup. The jellying tendency is considered to be due to the starch content of the juice. The desirability is suggested of selecting for breeding varieties of sorgho, the juice from which contains minimum quantities of starch at maturity.

**Contributions to chemistry of wood cellulose.**—III, The acetolysis reaction applied to cellulose isolated from commercial species of wood, L. E. WISE and W. C. RUSSELL (*Indus. and Engin. Chem.*, 15 (1923), No. 8, pp. 815-818).—In this continuation of the studies previously noted (*E. S. R.*, 50, p. 206), "cellulose isolated by the chlorination method from a number of commercial conifers and hardwoods was subjected to cold alkaline treatment. The  $\alpha$ -celluloses thus obtained, when acetolyzed under carefully controlled conditions, yielded appreciable amounts of cellobiose octa-acetate, which varied from 24 to 33 per cent of the theoretical yield. Under similar conditions, 'fibersilk' (from spruce) gave 24 per cent cellobiose octa-acetate, whereas carefully purified pine cellulose prepared by the sulphate process and normal cotton cellulose yielded 33 and 34 per cent, respectively. It is evident that as far as the cellobiose reaction is concerned, wood cellulose from different sources, and that isolated by different methods from the same source behave very similarly, and that the cellobiose grouping is characteristic of all the celluloses studied."

**The gelatinization of lignocellulose**, A. W. SCHORGER (*Indus. and Engin. Chem.*, 15 (1923), No. 8, pp. 812-814).—In this preliminary paper it is reported that the sawdust of coniferous woods, if ground with water in an ordinary earthenware ball mill, gelatinizes very completely. Under the same conditions hardwoods gelatinize very slowly, if at all, but if ground with dilute alkali they gelatinize even more readily than softwoods.

**The quantitative estimation of hemp and wood fibers in paper pulp**, W. DICKSON (*Analyst*, 48 (1923), No. 569, pp. 373-379, pl. 1).—Directions are given for the identification and quantitative estimation of hemp and wood fibers in paper pulp by microscopic examination under ordinary and polarized light. Photomicrographs are included.

## METEOROLOGY.

**Results of work on solar radiation**, C. G. ABBOT (*Smithsn. Inst. Rpt. Sec.*, 1923, pp. 107-110).—Briefly reviewing the work of the year on this subject under the auspices of the Smithsonian Institution, it is stated that "a comparison of two years of results on the variation of solar radiation observed at Mount Harqua Hala, Ariz., and Montezuma, Chile, shows close accord between the stations and agreement between them in showing forth solar changes of both long and short interval types. Monthly mean values of both stations indicate a long continued decline of the output of solar radiation beginning in November, 1921, and continuing at least until September, 1922. This is in some respects the most remarkable solar change on record." The author thinks there can be no longer "a reasonable question that the sun varies, or that our observations can reveal these variations satisfactorily. It is now a question for meteorologists whether these variations are of importance in weather forecasting." Clayton's use of the solar radiation data in actual weather forecasts is referred to.

Examination of two years of record prints from direct photographs and hydrogen (H $\alpha$ ) spectroheliograms of the sun made at the Mount Wilson Solar Observatory seems to establish four general rules or principles as follows: "(1) When increased sun spot activity appears, either by new spot groups forming on the visible solar disk, by the growth of spots already present, or by the coming on of a new group due to the solar rotation, then on that very day the solar constant value increases. (2) When a sun spot is carried by the solar rotation across the central diameter of the visible disk, then the solar constant value declines, and usually has a minimum on the day following such central transit. (3) When many spot groups, faculae, or long strings of dark hydrogen flocculi indicate that great solar activity is prevailing, the solar constant is high. (4) When a long quiescent period occurs in solar activity, the solar constant values steadily decline. These rules connecting the solar radiation with the sun's visible appearance seem to hold some promise of quantitative development."

**Lunar periodicity in reproduction**, H. M. Fox (*Roy. Soc. [London], Proc., Ser. B*, 95 (1924), No. B 671, pp. 523-550, figs. 9).—This is a more complete review and discussion of studies briefly referred to in an article previously noted (*E. S. R.*, 49, p. 115). It is stated in conclusion that "a belief in a variation in the bulk of marine invertebrates which serve as articles of food, correlated with the lunar period, was general in ancient Greece and Rome and persists to-day in countries bordering the Mediterranean and at Suez. It is shown in this paper that, while the belief is based on fact as concerns sea urchins in the Red Sea, it is false regarding sea urchins in the Mediterranean and other invertebrates in both seas. . . . There is no lunar periodicity in the rate of growth of fruits." The possibility of lunar photosynthesis in case of *Elodea* was tested with inconclusive results.

A list of 43 references to literature on the subject is given.

**Correlation in seasonal variations of weather, VIII**, G. T. WALKER (*Indian Met. Dept. Mem.*, 24 (1923), pt. 4, pp. 75-131).—This is a preliminary study of world weather, based on data recorded in 17 representative centers. The subject is discussed under the following chapter headings: Sun spots and pressure, sun spots and temperature, sun spots and winds, sun spots and cloud, sun spots and rain, discussion of the influence of sun spots, and solar radiation; relationships between centers of action; temperature variations; and physical interpretation of the relationships. For a review of the seventh contribution to this subject see a previous note (*E. S. R.*, 48, p. 208).

**Climatological data for the United States by sections** (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 10 (1923), Nos. 9, pp. [193], pls. 4, fig. 1; 10, pp. [188], pls. 4, fig. 1).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for September and October, 1923.

[Weather reports for Alaska, 1922] (*Alaska Stas. Rpt.* 1922, pp. 2, 16-25).—Tabular summaries are given of observations on temperature, precipitation, and cloudiness at 34 Weather Bureau stations in Alaska.

The season of 1922 was unfavorable for crop production in Alaska. Precipitation was excessive and the amount of sunshine small. As a result, grain matured badly. A cold wave in August, with temperature as low as 21° F. in some places, also reduced the grain crop.

**Meteorological observations at the Massachusetts Agricultural Experiment Station**, J. E. OSTRANDER and H. H. SHEPARD (*Massachusetts Sta. Met. Buls.* 419-420 (1923), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during November and December, 1923, are pre-



sented. The general character of the weather for November is briefly discussed, and the December bulletin gives a summary for the year. The principal data in this summary are as follows:

Mean pressure 30.02 in.; mean (hourly) temperature 46.6° F., maximum 97° June 19, minimum -12° January 31; total precipitation 39.49 in., snowfall 63.7 in.; cloudiness 1,686 hours; bright sunshine 2,773 hours; prevailing direction of wind, west northwest, total movement 48,864 miles, maximum daily 405 miles March 5; last frost in spring May 24, first in fall September 15; last snow April 15, first November 8.

**Weather observations, J. B. THOMPSON** (*Virgin Islands Sta. Rpt. 1922, pp. 14, 15*).—A table compares the monthly and annual rainfall at the Virgin Island Station for the year ended June 30, 1922, with the average for the years 1852-1911. The year 1921-22, like the preceding year, was abnormally dry, the rainfall amounting to only 33.57 in. as compared with the 60-year average of 46.81 in.

**The climate of Brazil, H. MORIZE** (*Contribuição ao Estudo do Clima do Brasil. Rio de Janeiro: Min. Agr., Indus. e Com., Observ. Nac. Rio de Janeiro, 1922, pp. VII+118, pls. 19*).—This is a classification and detailed description of the climate of Brazil, based upon a summary of available data up to 1920. The data are tabulated in detail, and typical climographs are given. This report forms part of a larger work entitled Historical, Geographical, and Ethnographical Dictionary of Brazil.

**The climate of Khartum, L. J. SUTTON** (*Egypt Min. Pub. Works, Phys. Dept. Paper 9 (1923), pp. [3]+65, pls. 20*).—The available data regarding pressure, temperature, rainfall, evaporation, humidity, clouds and sunshine, and wind are summarized and charted. The climate is shown to be distinctly continental. The lowest mean monthly temperature is 22.5° C. (72.5° F.) in January, the highest 34.1° in June. The air is very dry, and the evaporation high. The rainfall is small, averaging about 148 mm. (5.8 in.) per year. About 90 per cent of the rainfall occurs during July, August, and September.

## SOILS—FERTILIZERS.

**Physical and chemical studies on heavy clay soils, B. TACKE and ARND** (*Internatl. Mitt. Bodenk., 13 (1923), No. 1-2, pp. 6-26*).—Laboratory studies conducted at the Moor Experiment Station at Bremen, to determine the influence of different cultural treatments on the physical and chemical properties of heavy clay soils, are reported.

Liming and fertilization apparently had no influence on specific weight or volume weight, but liming alone increased the voids and apparently improved the physical condition of unfertilized as much as that of completely fertilized soils. Fertilization alone apparently increased void space somewhat. Water capacity was consequently found to depend in marked measure on fertilization and liming. Liming especially increased the absorption of water by both fertilized and unfertilized soils, but there was a vast difference between the water capacity of unfertilized and that of fertilized but not limed soils. The lowest figures were given by pasture soils. Liming of heavy clay soils decreased their hygroscopicity. It is concluded that in the cultural treatment of heavy clay soils the most important physical defect to overcome is cohesiveness.

Chemical studies showed that on heavy clay soils in the presence of more than 3 molecules of silica to 1 molecule of alumina, and in which the ratio of alumina to bases equaled unity or was less than unity, fertilization with phosphoric acid in the form of superphosphate had no favorable influence. Other soils under the same chemical conditions were benefited by such phos-

phatic fertilization. Potash fertilization had a partially similar effect on the clay soils, but this is not attributed to the molecular relation of alumina to bases.

**Egyptian soils under the régime of flooding irrigation**, V. M. MOSSÉRI (*Sultan. Agr. Soc., Tech. Sect., Bul. 12 (1923), pp. 41, pl. 1*).—This is a detailed discussion of the irrigation of Egyptian soils by flooding, with particular reference to the influence on the physical, chemical, and biological properties of the soil. The advantages of the newer methods of culture are also discussed.

**Rôle of soil cracks in permanent drainage and removal of salts from Egyptian soils**, V. M. MOSSÉRI and C. A. BEY (*Sultan. Agr. Soc., Tech. Sect., Bul. 11 (1923), pp. 11, pls. 4*).—This publication discusses the cracks occurring in Egyptian soils during the periods of summer fallow, with particular reference to their influence upon reclamation by drainage and alkali removal. Their most important function seems to be to improve soil aeration, since during the period of fallow the salts are apparently concentrated in the ridges between cracks.

**Factors affecting soil reaction.**—I, **The soil-water ratio**, R. M. SALTER and M. F. MORGAN (*Jour. Phys. Chem., 27 (1923), No. 2, pp. 117-140, figs. 5*).—In a contribution from the Ohio State University, studies made of the H-ion concentration of nine acid soils at soil-water ratios varying from 1:1 to 1:3,125 employing the hydrogen electrode method, and studies of sucrose hydrolysis at a range of soil-water ratios from 1:0.0894 to 1:625 on five soils, are reported.

The electrometric and sucrose hydrolysis methods were found to agree in indicating a systematic variation of H-ion concentration with variations in soil-water ratio, the highest H-ion concentration occurring at high soil-water ratios, with a progressive decrease as dilution was increased. In general, the changes in H-ion concentration at varying soil-water ratios agreed with the distribution of H-ions between soil and solution. A slight tendency was noted with all soils to deviate from the theoretical adsorption values over a restricted range of dilution. With two of the nine soils studied, this deviation was sufficient to prevent the determination of a theoretical equation which would describe the variations in H-ion concentration observed.

The results obtained were taken to indicate that the reaction of a soil is dependent upon, first, the total dissociated acid present, second, the adsorptive capacity of the soil for the H-ion, and third, the soil-water ratio. It is concluded that the reaction of a soil, as ordinarily determined by either electrometric or colorimetric procedures, is not an exact indication of the reaction of the same soil at normal field moisture contents. The authors suggest a soil-water ratio of 1:5 as being well suited to both colorimetric and electrometric procedures. Where a more accurate idea of the reaction at low moisture contents is desired, this can be obtained by extrapolation of the graph connecting the H-ion concentration determined at three soil-water ratios, preferably 1:5, 1:25, and 1:125.

**Soil reaction in relation to calcium adsorption**, C. O. SWANSON (*Jour. at the Kansas State Agricultural College on soils and other materials to which calcium in the form of calcium hydroxid was added in various amounts are reported*). A special apparatus was used by which it was possible to carry on six hydrogen electrode measurements at the same time. The pH values and the unadsorbed calcium were determined both in the presence and absence of potassium chlorid. Calcium carbonate was also used in some experiments.

The general effect of potassium chlorid was to increase the H-ion concentration except in soils which contained a comparatively large amount of calcium. It reduced calcium adsorption from 0 to 0.5, more being adsorbed with the larger amount of calcium hydroxid added.



The H-ion concentration was greater in the suspensions than in the extracts except where there was an excess of OH ions. Leaching a soil did not decrease the H-ion concentration nor the adsorptive power, although the latter was decreased by ignition. The addition of calcium carbonate and calcium hydroxid did not materially affect the pH values unless there was a long period of contact with the calcium carbonate. The amount of calcium adsorbed from calcium hydroxid was not affected by the presence of calcium carbonate. The adsorptive power of soil was more closely related to the clay content than to the original H-ion concentration.

Fuller's earth had a higher H-ion concentration and a greater adsorptive power than soil. The H-ion concentration and adsorptive power of soil when treated with hydrochloric acid and washed were the same, irrespective of the original calcium content of the soil.

The addition of small amounts of 0.04 N hydrochloric acid increased the H-ion concentration proportionately to the amount added. Oxalic acid of the same concentration decreased the H-ion concentration with the smaller portions and increased it with the larger portions of acid. This increase was not as great as with equivalent amounts of hydrochloric acid. The difference in the effect of the two acids is attributed to the formation of feebly ionized salts of a weak acid and strong base in the case of the oxalic acid.

The fundamental cause of the acid condition of a mineral soil is considered to be found in the chemical changes which accompany weathering, during which the bases are removed and the acid alumino-silicates accumulate. The harmful effect of these alumino-silicates is attributed more to the adsorption of calcium to such an extent that not enough is available for plant use, than to the higher H-ion concentrations.

**A comparison of the Jones calcium acetate method for lime requirement with the H-ion concentration of some Quebec soils, E. A. CERLETON** (*Soil Sci.*, 16 (1923), No. 1, pp. 79-90, figs. 2).—Studies conducted at Macdonald College, Quebec, are reported, in which good agreement between the electrometric and the colorimetric methods for determining the pH values of 51 Quebec soils was obtained. Some correlation between the H-ion concentration and the lime requirement by the Jones method seemed to hold in a general way for soils of the same type. The Jones method gave a lime requirement for neutral and slightly alkaline soils up to a reaction of about pH 7.6. Soils treated with lime water as indicated by the Jones method gave values which were in general close to neutral. Soils of high lime requirement were generally still slightly acid, while those of low requirement were usually slightly alkaline.

**Soil acidity, an ecological factor, A. P. KELLEY** (*Soil Sci.*, 16 (1923), No. 1, pp. 41-54, figs. 2).—In a contribution from the University of Pennsylvania the results of an intensive study made of a region about Paoli, Chester Co., Pa., including five soil types, are reported. This study was conducted in order to determine the actual soil acidity in a small area throughout the year with its effect on root distribution and the ecological distribution of wild plants.

The tests showed that the soil acidity increased to a depth of about 15 cm. (5.9 in.), after which it decreased, the increase being greatest in the most sterile soils. Soil acidity seemed to be correlated with soil productivity. Monthly tests revealed that there are slight variations from time to time in the soil acidity of a given spot, and that plants growing there can not be sensitive to small variations in the acidity. Excessive drying was usually accompanied by an increase in acidity, while heavy rains lowered it. Acidity was also increased during freezing. Absorbing roots were found chiefly in the least acid portions of soil and associated with fungi in the top 15 cm. of the more acid soils, the fungi becoming less abundant in the more nearly



alkaline soil. Descriptions of the soil types are given, indicating a correspondence between not only the facies but also the whole flora and its habitat.

**Exchange acidity of mineral soils**, H. LIESEGG and H. KAPPEN (*Landw. Vers. Sta.*, 99 (1922), No. 4-5, pp. 191-230, figs. 2).—Studies on ion exchange acidity in mineral soils are reported in which neutral soils were treated with dilute acids and salts of aluminum and iron.

All the acids used in dilute solution produced exchange acidity in neutral mineral soils. Apparently the aluminum ion was active in producing such acidity, while the iron ion was not. This is taken to indicate that the origin of exchange acidity in nature can not be attributed to any one acid, but that all phenomena contributing to the formation of acid in soils may participate in the production of exchange acidity.

Both aluminum and iron salts produced exchange acidity in soils when used in very dilute solutions. When a  $N/50$  solution of an iron salt was used, aluminum ions but no iron ions participated in the exchange. This is attributed to the strong hydrolysis of ferric salts, resulting in a complete absorption of the iron as hydroxid, so that no iron ions but only dilute hydrochloric acid would act on the soil after it was treated with iron chlorid.

Artificial aluminum silicate, or permutit, showed exchange acidity, but only when treated with carbon dioxid. Other acids and salts of aluminum and iron had no acid-producing effect, as they were entirely decomposed by the permutit. The mineral analcite showed only a small exchange acidity when treated with acids and salts, which is thought to be due probably to the difference between its structure and that of aluminum silicate.

Further studies established the uselessness of the colorimetric method for determining the amounts of lime required to remove exchange acidity in soils, and the usefulness of the Daikuhara method for determining total acidity.

**Manganese content of some Netherlands soil types**, D. H. WESTER (*Internatl. Mitt. Bodenk.*, 13 (1923), No. 1-2, pp. 1-5).—Analyses of several samples of different soil types of the Netherlands, indicating especially their contents of manganese, are reported and discussed.

These show that all the soils examined contained manganese. Intensely cultivated soils contained more manganese than unproductive and uncultivated samples of soil from dunes and deep borings. No constant relation was established between the iron and manganese contents. Loam soils contained the most manganese. That of truck soils was almost as high. The deeper older soil strata contained relatively more manganese than the newer formations. Phosphorite had a relatively high manganese content as compared with that of unproductive soils.

No relation was established between the manganese content of soils and that of plants grown thereon. The dry plant contained somewhat less but the plant ashes contained considerably more manganese than the soils. The iron content of the soil corresponded with that of the plants.

**Decomposition of neutral salts by humus materials**, H. HEIMANN and H. KAPPEN (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 6, Wiss., pp. 345-396).—Studies are reported which showed that naturally acid humus soils reacted with neutral salt solutions in exactly the same manner as the humus matter extracted from them or artificially prepared from sugar. This action is attributed solely to the so-called humus acids, and took place in two ways. In the first of these apparently a direct balanced reaction took place between the neutral salt and the free humus acid, resulting in an insoluble humus acid salt and the setting free of the acid of the neutral salt. In the second case apparently so-called iron or aluminum humates reacted directly with neutral salts, resulting in insoluble salts and acids of iron and aluminum.



The second reaction is considered to be that which usually takes place when neutral salts are added to mineral soils, resulting in an acid reaction. In this case the part of the humus acids is taken by silicic acid or aluminum silicates, with the important difference that the free silicic acid does not set free an acid from the neutral salt, but, through the exchange of iron and aluminum with which it is combined, acts to produce an acid reaction with the neutral salt.

Both types of reaction between humus and neutral salts could be produced under natural as well as artificial conditions. The simultaneous occurrence of these two types of reaction is thought to explain the lack of equilibrium between alumina and acidity which is frequently present in many humus soils.

The results are taken to indicate that real exchange acidity can be produced in soils by humus materials only on treatment with such substances as aluminum chlorid and when the humus contains mono- and bivalent cations, such as sodium, potassium, and calcium, in the form of so-called humates. It was impossible to bring trivalent cations into exchangeable form by direct treatment of the free humus acids with salts of iron and aluminum.

Phenomena occurring as the result of the action of acids on originally neutral humus soils are thought to be explained by the two acid-producing reactions described. Equilibrium was always lacking in neutral moor soils treated with acids in contrast to neutral mineral soils. This was attributed to the fact that the free acids dissolved and produced exchange acidity, setting free humus acids which decomposed neutral salts.

Concentrated aluminum salt solutions produced exchange acidity with equilibrium, while dilute solutions failed partially or entirely to do this. The lack of equilibrium under the action of neutral salts was always much greater than under the action of aluminum salts. No final conclusions are drawn, and the studies are being continued.

**The determination of the number of bacteria in soil,** C. L. WHITTLES (*Jour. Agr. Sci. [England]*, 13 (1923), No. 1, pp. 18-48, pls. 3, figs. 5).—In a contribution from the Cambridge School of Agriculture, studies are reported in which the usual shaking methods were examined and found unsatisfactory. As a result of this a method was evolved for the estimation of the number of soil organisms by a direct count. By this method the numbers were found to be very much higher than any previously reported. A method for the disintegration and dispersion of the soil particles and bacteria was also devised, by means of which plate counts were made which were comparable with direct counts.

A comparison of the dispersive actions of shaking and vibrating showed that the former gave results which depended on the moisture content of the soil, while the latter gave results in which the effect due to the moisture content was not apparent.

It is concluded that the most striking result of the use of the vibrator was the fact that the colonies grew so quickly and attained their maximum development both in size and in numbers in such a short time as 4 days, whereas from 10 to 15 days are required when the ordinary methods of shaking are adopted. It is suggested that this is due to the organisms having been free from the enveloping colloidal gels in which they are normally embedded. Their metabolic products gradually accumulate in the gels and so inhibit the growth of the colony. Dispersion of the gel involves the removal of these inhibiting substances, and rapid growth results.

The fact that counts of the same order were obtained by the plate method as by the direct method is considered to be fairly conclusive evidence that the low counts obtained by the usual shaking methods have little or no value. As

such counts usually range between one and several hundred millions, which is only a small fraction of the number found, it is considered more likely that the variations so far recorded are rather a measure of the ease with which a soil can be dispersed than of its bacterial content.

An extensive bibliography is appended.

**The relation of the reaction and of salt content of the medium on nitrifying bacteria,** C. S. MEEK and C. B. LIPMAN (*Jour. Gen. Physiol.*, 5 (1922), No. 2, pp. 195-204, fig. 1).—Studies conducted at the University of California to determine the relations between nitrifying bacteria and the reactions and concentrations of their media are reported. Garden soil, blow-sand soil, and peat soil were used to obtain the necessary bacterial cultures.

In a comparison of H and OH-ion concentrations for the freshly inoculated cultures with those first showing nitrification, it was noted that both nitrite and nitrate-forming organisms from the garden soil withstood extremely high concentrations of OH-ion, in one case pH 13 and in the other pH 13.1. Both organisms, however, while able to live and function in solutions of high pH value at the time when they began to yield their characteristic products, reduced the pH value of their media to 10.3 and 10, respectively. At the lower concentrations of sodium hydroxid employed, there was relatively little change in the OH-ion concentration from the initial value to that characterizing the solution when nitrite formation was observed. This was not so true of nitrate formation. After these organisms had reduced the pH values of their media more alkali was added, bringing the OH-ion concentration back to the original value, but nitrification was thereby stopped.

There was much less resistance to OH-ion concentration in the case of the peat soil organisms than in the case of the garden soil organisms, and no nitrate formation took place at pH values above 9.5. Even those organisms, however, produced nitrites from ammonia at a pH value of 9.3. This is taken to strengthen the evidence to the effect that the resistance of nitrifying bacteria to high OH-ion concentration is exceptional.

The organisms from the garden soil ceased the production of both nitrites and nitrates at pH values below 5.4. The peat soil, on the other hand, not only continued the production of nitrites from ammonium salts in solution with the pH value below 5.4 but did so at a pH value of 4.1, which was the most acid medium employed.

The results are taken to indicate that the peat soil organisms can not withstand as much OH-ion but can resist much more H-ion than the nitrifying bacteria from the other soils. While the data were not conclusive they seem to indicate, in general, that the nitrate-forming bacteria are slightly more resistant to alkalinity than the nitrite-forming bacteria.

Studies of the resistance of nitrifying bacteria to high salt concentrations resulted in the conclusion that the toxicities of sodium chlorid and sodium carbonate to nitrifying bacteria are of about the same order of magnitude, but that sodium sulphate is not nearly so toxic as either of the other salts.

**Progress of nitrification with time, with special reference to the periodic influence of time of year,** B. SCHÖNBRUNN (*Centbl. Bakt. [etc.]*, 2. Abt., 56 (1922), No. 23-24, pp. 545-565, figs. 6).—Studies are reported, the results of which showed that the progress of nitrification and ammonification with time were influenced the most by temperature. Time of year had no influence independently of temperature and other physical weathering influences. During a period of five months, presumably in winter, bacterial activity was low and its increase to a maximum was gradual. It was considered possible, therefore, for a maximum to occur in the spring.



**Microbiological analysis of soil as an index of soil fertility.—VI, Nitri-fication,** S. A. WAKSMAN (*Soil Sci.*, 16 (1923), No. 1, pp. 55–67, fig. 1).—In a further contribution to the subject from the New Jersey Experiment Stations (E. S. R., 50, p. 118), studies are reported on the nitrifying power of the soil. The results indicate that nitrification studies can yield information for the differentiation of soil fertility as well as the study of numbers of microorganisms in the soil.

**On the growth and respiration of sulphur-oxidizing bacteria,** S. A. WAKSMAN and R. L. STARKEY (*Jour. Gen. Physiol.*, 5 (1923), No. 3, pp. 285–310, figs. 6).—In a contribution from the New Jersey Experiment Stations, the results of a series of studies on the growth and respiration of *Sulfomonas thiooxidans* are reported.

These showed that *S. thiooxidans* oxidizes elementary sulphur completely to sulphuric acid and sodium thiosulphate completely to sulphate. This organism differed in this respect from various other sulphur-oxidizing organisms, which either produced elementary sulphur from the thiosulphate or converted it into sulphates and persulphates. The organism was found to derive its carbon from the carbon dioxide of the atmosphere, but was incapable of deriving it from carbonates or organic matter.

The ratio between the amount of sulphur oxidized to sulphate and the amount of carbon assimilated chemosynthetically from the atmosphere was 31.8 with elementary sulphur as a source of energy and 64.2 with thiosulphate. The higher ratio in the case of the thiosulphate was due to the smaller amount of energy liberated in the oxidation of the sulphur compound than in the elementary form. Of the total energy made available in the oxidation of the sulphur to sulphuric acid, only 6.65 per cent was used by the organism for the reduction of atmospheric carbon dioxide and assimilation of carbon.

Sulphates did not exert any injurious effect upon sulphur oxidation by *S. thiooxidans*. Any effect obtained was due to the cation rather than the sulphate radical. Nitrates exerted a distinctly injurious action both on the growth and respiration of the organism. There was a definite correlation between the amount of sulphur present and the velocity of oxidation, very similar to that found in the growth of yeasts and nitrifying bacteria. Oxidation reached a maximum with about 25 gm. of sulphur added to 100 cc. of medium. However, larger amounts of sulphur had no injurious effect.

Dextrose did not exert any appreciable injurious effect in concentrations less than 5 per cent. The injurious effect of peptone began at 0.1 per cent concentration, and brought sulphur oxidation almost to a standstill in a 1 per cent concentration. Dextrose did not exert any appreciable influence upon sulphur oxidation and carbon assimilation from the carbon dioxide of the atmosphere.

*S. thiooxidans* was able to withstand large concentrations of sulphuric acid. The oxidation of sulphur was affected only to a small extent even by 0.25 molar initial concentration of the acid. In 0.5 molar solutions the injurious effect became marked. The organism was able to produce as much as 1.5 molar acid without being destroyed. Growth was at an optimum at a H-ion concentration equivalent to pH 2 to 5.5, dropping down rapidly on the alkaline side but not to such an extent on the acid side, particularly when a pure culture was employed.

It was possible to study the respiration of the sulphur-oxidizing bacteria by using the filtrate of a vigorously growing culture to which a definite amount of sulphur was added and incubating for from 12 to 24 hours.

**Brazilian soils and protozoa,** M. PIETRE and P. DE SOUZA (*Compt. Rend. Acad. Agr. France*, 9 (1923), No. 25, pp. 676–681).—Experiments on soil pro-

tozoa conducted in connection with studies of unproductive garden and field soils and virgin soils, all of which were well supplied with organic matter and mineral nutrients, are reported. The microbic flora of these soils were abundant but gradually decreased.

The results are taken to indicate that the progressive sterility of these soils is due neither to bacteria nor protozoa, but to the accumulation of toxic products resulting from the prolonged growing of the same crops, and to the consequent increasing unavailability of chemical substances in the soil indispensable to active biological fermentation.

**Some protozoa found in certain South African soils, I, II,** H. B. FANTHAM and E. TAYLOR (*So. African Jour. Sci.*, 18 (1922), No. 3-4, pp. 373-393; 19 (1922), pp. 340-371).—Studies conducted at the University of the Witwatersrand, Johannesburg, are reported.

Examination by direct observation and by water culture of a number of South African soils from the Cape Province, the Transvaal, and Natal, under conditions of cultivation varying from virgin soil to heavily cultivated sugar land, showed the presence of genera of protozoa belonging to the Sarcodina, Mastigophora, and Ciliata. The genera and species varied considerably both with the locality and with the degree of cultivation of the soil.

Few trophic protozoa were detected in fresh nonwater-logged soil, the organisms occurring mostly in the encysted condition. The largest number of species obtained from any one soil was 22 and the smallest number was 1. Examinations of water-logged soil showed the presence of trophic protozoa, which were relatively abundant as compared with those of nonwater-logged soils, and contained some different genera. The relative abundance of any one kind in different soils varied considerably. The sequence of appearance of the different groups of protozoa in water culture was usually Mastigophora, Ciliata, and Sarcodina. Ciliata were the most numerous as regards species, and the other two groups were about equal in this respect. From the point of view of actual numbers, the flagellates were the most numerous. The ciliates persisted longer in a culture than any other class of protozoa.

Room temperature of from 15 to 20° C. (59 to 68° F.) produced better growths of protozoa in cultures than did higher temperatures. Darkness seemed to make little difference in the rate of development of cultures. Dark, heavy soils containing much humus yielded more kinds of protozoa than sandy soils, the amount of organic matter apparently being a limiting factor. Samples of soil taken near the surface usually yielded more protozoa than deep samples. Transvaal and Natal soils collected toward the end of the summer, the rainy season, yielded more kinds of protozoa than those collected in winter. Cultivated soils tended to yield more species than uncultivated soils.

Cysts of protozoa were very closely attached to the soil particles. It was experimentally determined that the more finely the soil was pulverized the more protozoal cysts could be detected.

Relatively few bacteria appeared to occur in South African soils, probably due to the dryness and large amount of sunshine, causing partial sterilization. The ingestion of bacteria by amoebae, flagellates, and ciliates was observed on only a few occasions.

The second paper includes examinations made of more South African soils from the Cape Province, Transvaal, and Orange Free State. Some soils from southern Portuguese East Africa were also examined. An increase in the number of genera and species of protozoa in water-logged soils was noted.

Cultures of virgin and cultivated Karroo soil taken at 6 and 9 in. deep showed differences in numbers of both organisms and genera. A comparison of these soils with one another and with Liesbeek soil taken at a depth of 6 in.



showed that three flagellates and one ciliate were common to all. The other protozoa showed divergence. The same soils taken at 9 in. deep contained one thecamoeba, three flagellates, and one ciliate in common, but these organisms common to each soil were almost entirely different from those common to the same soils taken at a depth of 6 in.

The culture area exposed appeared to influence the number of trophic protozoa detected, shallow cultures yielding more organisms than deeper ones. Darkness and light appeared to have little influence on the rate of development of protozoa in cultures, with one exception, where a reaction was noted to the sudden application of light. Fertile soils appeared to contain larger numbers of individual protozoa than infertile soils. Cultivated soils, in general, while not yielding more species of protozoa than uncultivated soils, contained more protozoan individuals in cultures. With reference to the sequence of the appearance of protozoa in cultures of soil from different depths, the flagellates appeared to develop relatively early in cultures from any depth of soil. Some ciliata appeared much earlier in cultures than others. Seasonal variation in the protozoan fauna of certain soils is indicated.

**Soil survey of Perry County, Ark.,** E. B. DEETER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+493-536, fig. 1, map 1*).—This survey deals with the soils of an area of 353,280 acres situated entirely within the Ouachita Mountains slightly northwest of the center of Arkansas. The topography varies from level to rugged and mountainous. The areas with poor drainage are said to be small as compared to the well-drained, undulating valley areas and ridge slopes.

The soils are of residual and alluvial origin, the former covering much the larger part of the county. Including rough stony land and riverwash, 30 soil types of 13 series are mapped, of which the Hanceville stony loam and stony fine sandy loam cover 46.8 and 11.4 per cent of the area, respectively.

**Soil survey of the Brawley area, Calif.,** A. E. KOCHER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. IV+641-716, pls. 5, fig. 1, maps 2*).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 391,040 acres occupying the northern part of Imperial Valley in the extreme southern part of California. Physiographically the area is part of a depressed basin, the greater part of which is below sea level. The drainage of the entire area reaches the Salton Sea. The area is located in the southwest desert region, and the hot and dry climatic conditions are said to be plainly reflected in the character of the soils. Excepting certain areas of wind-laid soils, the soil materials in the section below sea level are mainly of heavy texture, compact, characteristically chocolate brown or purplish brown in color, stratified, calcareous, and deficient in organic matter. Including dunesand, riverwash, rough stony land, and rough broken land, 29 soil types of 8 series are mapped, of which the Imperial clay and silty clay cover 20.4 and 16.8 per cent of the area, respectively.

**Soil survey of Dickinson County, Iowa,** J. A. ELWELL and J. L. BOATMAN (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+599-639, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 240,640 acres in northwestern Iowa. The topography varies from rolling to undulating and level, averaging a gently rolling relief. Drainage ways reach all parts of the area except the level drift plains, but the drainage is sluggish and the channels range from tortuous to moderately regular in development.

The soils are mostly of glacial origin and are grouped as upland, terrace, and bottomland soils. Including muck, 19 soil types of 10 series are mapped, of

which the Clarion loam, Lamoure silty clay loam, and Webster silt loam cover 40.4, 15.8, and 10.5 per cent of the area, respectively.

**Soil survey of Dubuque County, Iowa,** J. O. VEATCH and C. L. ORRBN (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+345-369, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 384,640 acres in northeastern Iowa. The topography in general is rolling to moderately hilly, with a considerable area of bluffs and broken land along the Mississippi River. A complete system of streams has been developed providing thorough natural drainage.

The soils are grouped as (1) those composed mainly of silt and very fine sand to a depth of from 3 to 5 ft. or more, (2) those characterized by a comparatively high percentage of mineral particles coarser than silt or clay and ranging from fine sand to coarse sand and gravel, (3) those characterized by light brown or grayish brown and dark brown surface soils underlaid by yellowish and reddish clay and an impenetrable substratum of limestone at shallow depths, (4) those including sand, silt, and clay soils which are developed on terraces and are of the same geologic origin, and (5) those developed from alluvial deposits of the first bottoms or flood plains along the streams. The soils in general are said to be naturally fairly well supplied with organic matter, moderately retentive of moisture and of durable fertility. Silt loams greatly predominate, occupying nearly 85 per cent of the total area. Including riverwash, 20 soil types of 13 series are mapped, of which the Clinton and Tama silt loams cover 50.4 and 19.6 per cent of the area, respectively.

**The comparative crop effect of fertilizer chemicals, cow manure with straw bedding or with planer shavings bedding, and of the latter supplemented with phosphorus or potassium,** B. L. HARTWELL, S. C. DAMON, and F. K. CRANDALL (*Rhode Island Sta. Bul. 196 (1923), pp. 3-12*).—The results of nine years' studies with a 3-year rotation of oat and pea hay followed by rutabagas, silage corn, and timothy and clover hay on  $\frac{2}{5}$ -acre plats of Miami silt loam soil are reported.

The crops receiving straw manure averaged about a tenth larger than those receiving planer shavings manure. Hay crops receiving shavings manure supplemented with acid phosphate or with potash salts responded about the same to each addition. The crop of rutabagas increased only with the phosphorus, but these larger crops seemed to depress the yields of corn during the next year.

Where fertilizer chemicals and no manure were used, the yields were about equal to those where manure only was used. The soil contained less water, organic matter, and nitrogen during the ninth year following an unusually dry period where fertilizer rather than manure had been used. Applications of lime and ashes resulted in a pH value of about 5.7. Where shavings manure was used, the pH and active aluminum determinations indicated a slight tendency toward more pronounced acid soil conditions than where straw manure was used.

**A 10-year fertilizer test on muck soil,** M. E. MCCOLLAM (*Western Washington Sta. Bimo. Bul., 11 (1924), No. 5, pp. 92-97*).—The results of a 10-year fertilizer test with corn, potatoes, kale, and mangels in a 4-year rotation on a typical acid muck soil are briefly presented, continuing previous reports (*E. S. R., 42, p. 517*).

Potassium caused a much greater crop response than nitrogen, phosphorus, or lime, and is considered to be the most serious nutrient deficiency in this soil. Cow manure produced the highest yields of all crops. A complete



fertilizer containing considerable potash was next except on potatoes, where potassium sulphate alone gave slightly better results.

Mangels yielded poorly under all treatments except cow manure and complete fertilizer. The potato crop was the most sensitive to a potash deficiency. Kale and corn responded very little to any fertilizer treatments except cow manure and complete fertilizer. They seemed able to adapt their growth to small quantities of potash, provided nitrogen was sufficiently abundant. The unfertilized muck soil, although deficient in potash, supported fairly good crops of kale and corn throughout the 10-year period.

Some of the fertilizer treatments notably increased the resistance of kale, mangels, and potatoes to plant diseases. This effect was very consistent on potato crops receiving treatments of cow manure, complete fertilizer, potash, and potash with superphosphate.

**Healing of "sick" soils,** O. NOLTE (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 11, *Wirtschaft.-Prakt.*, pp. 526-530).—The results of studies of soils rendered unproductive in the neighborhood of smelters and other industries are briefly summarized. In all cases studied it was found that these soils regained their productivity after proper treatment with mineral fertilizers, especially lime and nitrogen.

**Investigations of the manufacture of phosphoric acid by the volatilization process,** W. H. WAGGAMAN, H. W. EASTERWOOD, and T. B. TURLEY (*U. S. Dept. Agr. Bul.* 1179 (1923), pp. 55, pls. 12, figs. 10).—A summary of the work done by the Bureau of Soils, on the manufacture of phosphoric acid by the volatilization process is presented, the purpose being to show its commercial possibilities. Most of this work has been noted in the *Record* from time to time from other sources.

Special attention is drawn to the work which has demonstrated conclusively the feasibility of driving off phosphoric acid from run-of-mine phosphates in large-scale operations by means of burning fuel. It has been shown that a furnace can be constructed which will withstand the combined effects of extremely siliceous slags and the high temperatures attained in this process for a protracted period.

It is concluded that, if the data taken at times when the furnace appeared to operate efficiently are indicative of normal working conditions, the volatilization method of producing phosphoric acid appears to be economically superior to the ordinary sulphuric acid method or to the electric furnace process.

**The significance of mica minerals as a source of potassium for plants,** V. M. GOLDSCHMIDT and E. JOHNSON (*Norges Geol. Undersøk.* No. 108 (1922), pp. 89, fig. 1; *abs. in Chem. Abs.*, 17 (1923), No. 5, p. 846).—Data on the occurrence, distribution, and composition of potash-bearing minerals in Norway are presented and discussed, particular reference being made to the availability of their potash contents. The average potassium content of Norwegian rocks was found to be with feldspar 15 per cent, muscovite 5, and biotite 10 per cent. The last two are apparently of the most importance in Norway because of their wide distribution and the relative ease with which their potash content becomes available through weathering. Experiments showed that the potash content of the mica minerals is more easily soluble in reagents than that of feldspar.

It is concluded that the acid and salt solutions in the soil have a marked solvent action on the potassium in mica minerals, and that this process is an important factor in plant life in Norway. Lines for further investigations are suggested.

**The influence of calcic and magnesian additions upon the outgo of sulphates from a loam soil as measured by lysimeter leachings over an 8-**

year period, W. H. MACINTIRE, W. M. SHAW, and J. B. YOUNG (*Soil Sci.*, 16 (1923), No. 1, pp. 1-40, figs. 8).—The results of an 8-year study, conducted at the Tennessee Experiment Station, of annual sulphate leachings from tanks containing surface soil and surface soil plus subsoil, as influenced by nine different calcic and magnesian materials in different amounts and carried out by the use of 46 field lysimeters, are reported.

At the 8-ton rate calcium oxid, magnesium oxid, calcium carbonate, magnesium carbonate, 100-mesh limestone, dolomite, and magnesite materially increased the loss of sulphates from the surface soil. Compared with the initial annual outgo, there was a distinct diminution in all of the losses from the surface soil after the first year. The tendency of the subsoil losses was to increase from minimum initial outgo, the amount of increase depending upon the solubility of the alkali-earth addition. The differences between the 8-year outgo of sulphates from surface soil and from surface soil plus subsoil were greatest in the case of the native carbonate treatments.

At the 32-ton rate calcium oxid had a distinctly depressing influence in contrast to the activating influence of the magnesium oxid and the carbonates. The sulphate losses from the surface soil decreased for all treatments except calcium oxid after the first year. Those from the subsoil tanks were greatest for the magnesium oxid and magnesium carbonate treatments during the second and third years, while the smaller losses from the less soluble materials and calcium oxid did not become maximum until the third or fifth years.

At the 100-ton rate calcium oxid was exceedingly effective in stopping sulphate losses from the surface soil, but after the fourth year the heavy addition became active in forcing sulphate from the subsoil zone. All other materials increased the surface soil losses to excessive amounts during the first year, the magnesium oxid and magnesium carbonate being the most active in this respect. Dolomite caused a maximum surface soil outgo for the 8-year period. Magnesium oxid and magnesium carbonate were the first to force surface soil sulphates through the subsoil, the largest amounts coming during the third year. The less soluble materials showed increased losses from the subsoil during the fifth, sixth, and seventh years.

The influence of magnitude of treatment varied. An increase in the applications of burnt lime was followed by progressive depression of surface soil sulphate outgo, but only the heaviest application depressed the total below that of the control. No consistent increase in sulphate outgo from the surface soil resulted from an increase in the rates of treatment of calcium carbonate, limestone, or magnesite. The sulphate increases in the subsoil leachings were found to be more dependent upon the solubility than the quantity of the alkali-earth additions, and ran parallel with increased concentration of the applied base in leachings.

With the exception of calcium oxid at 32- and 100-ton rates, every treatment at each rate caused a loss of more than one-half of the original sulphur content of the surface soil. With the same exception all treatments caused losses in excess of the rainfall sulphur. All treatments at the 8-ton rate induced sulphate losses approximately 35 per cent of the sulphur available from all sources. The same was true of all surface soil losses resulting from the 32- and 100-ton additions of magnesium oxid, calcium carbonate, magnesium carbonate, limestone, and magnesite.

The sulphur loss from each of the seven treatments at each rate was less than the amount originally present in the soil plus subsoil. With the exception of calcium oxid and limestone at all rates, dolomite and magnesite at the 8-ton rate, and calcium carbonate at the 32-ton rate, each of the seven materials caused subsoil sulphate leachings in excess of the amount of sulphate carried



by the rainfall. Unaltered subsoil stopped large amounts of sulphates, and the influx of calcium and magnesium salts served to diminish and even overcome this property and in some cases to push sulphate through the subsoil.

**Influence of calcic and magnesian treatments upon sulphate leachings from soil alone and with additions of ferrous sulphate, pyrite, and sulphur,** W. H. MACINTIRE, W. M. SHAW, and J. B. YOUNG (*Soil Sci.*, 16 (1923), No. 3, pp. 159-182, figs. 2).—In a further contribution to the subject, sulphate analyses of 614 collections from 22 lysimeters over a 5-year period are reported. These analyses were made in connection with a study of the loss of native stores of sulphurous materials and recoveries of sulphur derived from rainfall and 1,000-lb. per acre additions of sulphur as ferrous sulphate, pyrite, and elementary sulphur, as these are influenced by various forms and amounts of calcic and magnesian materials.

The results showed that economic and equivalent applications of burnt lime, magnesia, limestone, and dolomite were practically identical in their accelerative influences upon the oxidation of native sulphurous materials. The oxidation of powdered sulphur was increased by small amounts of both lime and magnesia. It was found, however, that undesirable losses may be caused by the injudicious use of these in amounts which may be considered as within the practical range. Pyrite is considered as a source of sulphur where less rapid generation is desired, particularly in an acid soil, since both lime and magnesia depressed the amounts of water-soluble sulphates formed. The use of excessive amounts of either calcium oxid or magnesium oxid is considered to be inadvisable in connection with either sulphur or pyrite.

## AGRICULTURAL BOTANY.

**Effect of seeds upon H-ion concentration of solutions,** W. RUDOLFS (*Bot. Gaz.*, 74 (1922), No. 2, pp. 215-220).—In the course of a study on the effect of single salt solutions with definite osmotic concentration values upon absorption by seeds (*E. S. R.*, 47, p. 730), it was found that the H-ion concentrations of the solutions changed markedly during the process of imbibition. On account of the interest and importance of this phenomenon in connection with seed studies, single salt solutions of magnesium sulphate, sodium nitrate, calcium nitrate, sodium chlorid, potassium chlorid, and potassium carbonate were prepared, ranging in osmotic concentration values from 0.001 of an atmosphere to 7 atmospheres, the seeds used in connection with these solutions being corn, spring wheat, white lupine, watermelon, Canada field pea, Japanese buckwheat, dwarf Essex rape, and alfalfa. The work and results are presented in tabular detail with discussion.

The H-ion concentrations of the solutions were markedly increased by contact with the seeds, even when strongly alkaline solutions of potassium carbonate were used. The initial H-ion concentration of the solutions of each salt increased slightly with the progressive decrease in the total salt concentration, but the pH values of all but the very dilute solutions after soaking the seeds in them for 15 hours showed a striking similarity. The effect of the seeds upon the H-ion concentration of the solutions is strikingly shown in the case of potassium carbonate.

The maximum reaction change which the seeds were capable of bringing about in the small quantities of solution here used was accomplished in a comparatively brief period of time.

The exact cause or causes of the rapid reaction change of the solutions has not been determined with absolute certainty. There are doubtless several

contributing factors, but probably the primary and principal factor is that directly related to ion absorption by the seeds, the H-ion concentration increasing as the cations are removed from solution by absorption at a more rapid rate than the anions. This accords with the work of Pantanelli (E. S. R., 35, p. 433), who concludes that salt intake by the cells of living plants is an absorption phenomenon of single ions and attributes the reaction changes of solutions in contact with the roots of green plants to the fact that some ions are absorbed at a more rapid rate than others.

**A comparison of the absorption of inorganic elements, and of the buffer systems of legumes and nonlegumes, and its bearing upon existing theories,** J. D. NEWTON (*Soil Sci.*, 15 (1923), No. 3, pp. 181-204, figs. 12).—The primary object of these experiments was to study the selective action of different plants as measured by the proportions in which they absorb different elements from soils and nutrient solutions. It was thought advisable to take plants which under ordinary field conditions are believed to differ considerably in composition and to grow them under more carefully controlled conditions in order to discover whether the differences are really characteristic or simply the result of different environments.

A second object was to examine the theory attributed to F. W. Parker and E. Truog regarding calcium and nitrogen relationships in plants, according to which the building up of proteins in plants involves the production of organic acids as by-products, which are neutralized and precipitated by calcium. Another object was to study the plant sap of legumes and nonlegumes, with special reference to calcium absorption.

As to the general type of experimentation, in nearly all cases the legumes and nonlegumes were grown side by side in nutrient solutions, soil or sand cultures, and the plants or solutions analyzed at various stages of plant growth. The plants for the sap studies were grown similarly and were frozen immediately after harvesting. Later they were thawed out, the expressed juice was titrated with the hydrogen electrode, and samples were analyzed for certain elements.

Comparisons, at four different stages of growth, of percentage composition and of ratios in which ion equivalents were absorbed produced no evidence of characteristic differences in the types of absorption from nutrient solutions by barley and peas or by barley and vetch. The evidence indicates a characteristic difference in the type of absorption of barley and beans in the early stages. Beans (Speckled Cranberry) absorb more calcium in proportion to potassium from a given nutrient solution than do either barley or peas. The quantity of calcium absorbed by a plant does not necessarily, it is claimed, depend upon the quantity of nitrogen absorbed or metabolized. Peas were found to contain a much higher percentage of calcium than barley, and a considerably higher percentage of magnesium when they were grown side by side in an adobe soil.

The quantity of carbon dioxide given off from the roots of pea plants grown in sand cultures was very much greater than that given off from barley roots of similar size.

Evidence was obtained in the case of barley, peas, and beans that the H-ion concentration of the plant sap was not appreciably increased by limiting the calcium supply. Analyses proved in these cases that there was actually less calcium present in the sap and a smaller percentage in the plant as a whole. The buffer effect of barley and pea sap was similar, but was greater in the case of beans.



**The viscosity of protoplasm**, F. WEBER (*Naturw. Wehnschr.*, 37 (1922), No. 9, pp. 113-125).—A review is given of studies on protoplasm as recorded, with citations to about 60 related contributions.

**Study of the early products of chlorophyll assimilation of carbon**, E. ROUGE (*Schweiz. Apoth. Ztg.*, 59 (1921), Nos. 11, pp. 157-161; 12, pp. 175-178).—In the work here briefly described the author claims to have shown that experimentation reported by Kimpflin (*E. S. R.*, 23, p. 330) and work ascribed to Pollacci do not prove the presence of formaldehyde in the living plant, though it is claimed as possible, in ways indicated, to show evidence of its presence during assimilation. Related substances are indicated as localized or detected.

**Photocatalyses in plants**, K. BORESCH (*Naturwissenschaften*, 10 (1922), No. 22, pp. 505-512).—This is largely an account of contributions by others on photocatalysis, a list of references to which studies is furnished.

**Protective power against salt injury of large root systems of wheat seedlings**, W. F. GERICKE (*Bot. Gaz.*, 74 (1922), No. 2, pp. 204-209).—Having found that wheat plants can be made to grow very large root systems as compared with top growth by utilizing certain properties of nutrient solutions, also that under certain conditions large root systems of wheat seedlings from four to six weeks old play an important part in the number of tillers the plant may produce, the author undertook experimentation where differences in the extent of the root systems of the plants would enter as the variable factor. It seemed reasonable to expect that the relative physiological values or growth efficiencies of different nutrient solutions, and the tolerance of plants to salts, were perhaps considerably affected by the extent of the root development of the test plants when placed in the media. The present paper bears upon an investigation on these points as carried out with plants having extensive or limited root systems in solutions indicated and rated as good, medium, or poor. The work and results are described in some detail.

The extent of the root system appears as an important factor affecting the magnitude of growth obtainable from a given nutrient solution. It is conceivable, therefore, that the extent of the root systems of plants constitutes an important factor when plants are grown in the field. The common observance in the field of a greater tolerance for salts of older plants than young ones apparently can well be accounted for in their root systems. This, however, does not mean that differences in extent of root systems any given kind of plant may have are due only to causes operative in the external environment. Differences in root systems may also be due to genetic factors.

**Excretions from leaves as a factor in arsenical injury to plants**, C. M. SMITH (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 4, pp. 191-194).—In connection with studies of the effect of calcium arsenate when applied to cotton plants for the control of the cotton boll weevil, the author found that dew on cotton plants contained large quantities of salts which in laboratory tests acted upon calcium arsenate so as to increase greatly the water-soluble arsenic content. It is believed that excretions from leaves must be considered in explaining arsenical injury to plants, and that this factor may be of value in estimating the suitability of an arsenical for a particular purpose.

**Hot-water treatment of sugar cane for insect pests.**—A precaution, P. A. YODER and J. W. INGRAM (*U. S. Dept. Agr., Dept. Circ. 303* (1923), pp. 4).—In connection with experiments for the control of insect pests of sugar cane by treating the seed cane with hot water, the effect on the plant was studied and it was found that the eyes of the cuttings were not killed in the pieces of stalks bearing single eyes, with temperatures up to 50° C. (122° F.) for the



duration of 30 minutes. However, if the plants were beginning to sprout the treatment proved injurious. If subjected to hot water, cane cuttings that had sprouted during winter storage should not be used.

**The effect of slope exposure upon the climate and vegetation of a hill near Maritzburg,** R. D. AITKEN (*S. African Jour. Sci.*, 19 (1922), pp. 207-217, fig. 1).—The results of this preliminary investigation, as summarized, show that marked differences exist in the character of the vegetation between the northern and southern slopes of the hill at Pietermaritzburg chosen for this experimentation. These differences are supposedly due principally to differences in the climatic conditions, but partly also to differences in the soil conditions. The two slopes show, even in the course of a single day, marked differences in such environmental factors as sunlight intensity, air temperature, evaporation rate, and soil temperature. The soil on the southern slope is considerably more moist than that on the northern. Trees of *Cussonia spicata* show a higher transpiration rate on the southern slope than on the northern.

**Naturalization of plants [in New Zealand],** G. M. THOMSON (In *The Naturalization of Animals and Plants in New Zealand*. Cambridge, Eng.: Univ. Press, 1922, pp. 363-501, 569-607).—Part 3 (chapters 11 and 12) of this work deals with plants introduced into New Zealand, over 600 species of which, as listed, have become more or less wild, reproducing by means of seed and appearing to be more or less permanent. Reference is made also to several species of plants which have resisted all efforts to naturalize them. To a number of the introduced plants referred to, the author has appended the names of insects also introduced which pollinate or at least visit the flowers of some species. An extended bibliography and an index refer to both animals and plants.

**Agricultural bacteriology,** J. E. GREAVES (*Philadelphia: Lea & Febiger*, 1922, pp. XV+17-437, figs. 48).—The organisms considered in agricultural bacteriology are specifically the most numerous, chemically the most active, and economically the most important known. The present work, intended for the use of teachers and students in agriculture, presupposes a knowledge of elementary chemistry. In its preparation, the author has gone into considerable detail in dealing, for example, with soils, though in case of such matters as milk, water, and sewage, where good, complete volumes are already available only a bare outline is furnished.

Lists of related literature are given in connection with most of the 36 chapters, and the last of these closes with a list of additional works which are recommended.

**Morphology and biology of bacteria,** F. LÖHNIS (*Centbl. Bakt. [etc.]*, 2. Abt., 56 (1922), No. 23-24, pp. 529-544, pls. 2, fig. 1).—Facts are outlined indicating that among bacteria, protozoa, lower fungi, and algae far more numerous analogies exist than are to be expected from current statements regarding the uniformity and simplicity of bacteria.

**Further studies on the morphology of bacteria,** H. BERGSTRAND (*Jour. Bact.*, 8 (1923), No. 4, pp. 365-372, pl. 1, fig. 1).—The author discusses theories concerning forms in bacteria supposed to be organs of sexual and asexual multiplication, describing spherical, ovoid, or club-shaped bodies, found by himself in certain species, and regarded as chlamydo spores.

**Gelatin liquefaction by bacteria,** M. LEVINE and D. C. CARPENTER (*Jour. Bact.*, 8 (1923), No. 4, pp. 297-306, figs. 2).—Though liquefaction of gelatin is generally recognized and employed as a fundamental criterion for the differentiation of bacterial species, the methods in vogue for observing this property are still crude and unreliable. A method capable of being employed over a wide range of temperature for measuring the rate of liquefaction of gelatin by bacteria is much needed. In this preliminary paper some observations are



recorded on the change in viscosity and formol (Sörenson) titration of gelatin subjected to bacterial decomposition.

The change in viscosity of a gelatin medium and simultaneous rate of increase of the formol titration was observed with seven organisms. The viscosity was found to drop before the formol titration began to rise. The rate of increase in formol titration serves to distinguish two types of gelatin liquefiers.

A standardized method for ascertaining the change in viscosity of gelatin culture media should be far superior to the present methods of detecting gelatin liquefaction. A temperature of 40° C., which is slightly above the gelation point, is suggested as desirable for this purpose and is now under investigation.

## GENETICS.

**Genetics**, M. G. VERPOORTEN (*Rev. Gén. Agron., n. ser., 13 (1923), Nos. 2, pp. 33-48, fig. 1; 3-4, pp. 94-101, fig. 1; 5-6, pp. 105-126*).—This is a popular presentation of the principles of genetics, discussing Mendelism and related phenomena in particular.

**The modern theory of genetics and the problem of embryonic development**, T. H. MORGAN (*Physiol. Rev., 3 (1923), No. 4, pp. 603-627, figs. 8*).—This is a brief review of the theory of genetics, with final reference to the lack of a scientific explanation of the manner by which the genes in the chromosomes determine body characters.

**Theories basing studies on Oenothera**, E. LEHMANN (*Die Theorien der Oenotheraforschung: Grundlagen zur Experimentellen Vererbungs- und Entwicklungslehre. Jena: Gustav Fischer, 1922, pp. XVIII+526, pl. 1, figs. 207*).—As a basis for experimental studies on heredity and development, the author offers this comprehensive work with bibliography (374 titles) presenting theories and facts as known in connection with species, hybrids, and mutants of Oenothera.

**Factors which determine otocephaly in guinea pigs**, S. WRIGHT and O. N. EATON (*Jour. Agr. Research [U. S.], 26 (1923), No. 4, pp. 161-182, pl. 1, figs. 3*).—Eighty-two cases of otocephaly which have occurred in the stocks of guinea pigs at the U. S. D. A. Experimental Farm at Beltsville, Md., are classified according to the grades of this condition shown and according to their breeding. The grades ranged from 1 in which there was reduction of the lower jaw to 11 in which the proboscis and all the visible external organs of the head have disappeared except two small ears. Fifty of the 82 cases occurred in the inbred family No. 13 (E. S. R., 48, p. 263), 3 in the crossbred stock and 1 in the control stock, the balance being fairly well distributed over 9 other inbred families. The percentage of otocephaly, based on total young born, was 1.54 in family 13, 0.93 per cent in family 19, and less than 0.34 per cent in all the other families, averaging 0.11 per cent for the inbred families after excluding family 13. A more careful study of family 13 showed that in certain sublines as high as 21.5 per cent of otocephaly occurred. The sexes of the abnormal animals were unequal, 55 being females, 26 males, and 1 undetermined.

The factors influencing the cause of this abnormality seemed to be difficult to determine. The more frequent occurrence within certain inbred lines and sublines tends to point toward the operation of genetic factors, but, considering the rate of appearance in other strains and crossbreds, it seems difficult to show cause for this condition on the basis of Mendelian segregation or mutation.

Several hypotheses were offered but shown to be inadequate, the authors finally concluding that the fundamental cause was probably delay or irregularity in implantation of the embryo at a critical moment in ontogeny. Unfavorable

environmental conditions as measured by size of litters, percentage of young raised to 33 days of age, mortality of litter mates, birth weights, etc., tend to increase the percentage of otocephali born. Litter mates of otocephali are little if any more likely to suffer the defects than nonlitter mates. It is suggested that genetic factors may play a part in causing the condition by accelerating or inhibiting metabolism.

**Chromosome relationships and genetic behavior in the genus *Drosophila*.—I, A comparison of the chromosomes of different species of *Drosophila*, C. W. METZ and M. S. MOSES (*Jour. Heredity*, 14 (1923), No. 5, pp. 195–204, pl. 1, figs. 5).—**The 12 different types of chromosome groups which have been found in the genus *Drosophila* are described, as well as the chromosome group in the *Gladochaeta nebulosa*. The possible relationship between these different types is indicated and discussed.

**The inheritance of spangling in poultry, G. LEFEVRE and E. H. RUCKER (*Genetics*, 8 (1923), No. 4, pp. 367–389, figs. 35).—**A number of crosses to determine the mode of inheritance of spangling that exists in the Silver Spangled Hamburg have been made at the University of Missouri. A cross between a Brown Leghorn female and a Silver Spangled Hamburg male produced 3 black and 22 spangled birds with more or less solid black in the tail and in certain cases in the body feathers. In the reciprocal cross 19 spangled cocks with black tails and 3 black cocks were produced, while the hens were all black with a little golden brown lacing on the neck. The  $F_2$  generation and back crosses made clearly demonstrated that the spangling character was due to a dominant factor located in the Z-chromosome. The black birds in the first cross and the black males in the second cross noted above were shown to behave genetically as birds heterozygous for spangling. The variations in the amount of black in spangled birds indicate that modifiers for black are present which may obscure the appearance of spangling from certain birds or from the entire bird. Another unexpected condition was the replacement of the white in the spangling pattern of several birds by a golden bay color which is probably recessive to white.

**Heritable characters of maize, XIV–XVI (*Jour. Heredity*, 14 (1923), Nos. 6, pp. 243–251, figs. 6; 7, pp. 297–300, fig. 1; 8, pp. 349–351, figs. 2).—**Previous numbers of this series have been noted (E. S. R., 49, pp. 632, 826).

**XIV. Branched ears, J. H. Kempton.**—The type of branched ear studied appeared among the progeny of a selfed ear of a Pawnee Indian variety and is characterized by from one to many 4-rowed branches at the base of the ear, usually with fully developed seeds. These branches are naked but are inclosed in the husks enveloping the ear. This form of branching was not inherited according to the Mendelian system, and it was not found possible to isolate a uniform branch-eared strain or even to approach that condition. Repeated self-pollination did not serve to stabilize the amount of branching, and the percentage of nonbranched plants did not decline. About five normal plants to one bearing branched ears were produced. The variability of branching is considered as a phenomenon of expression rather than transmission. The branched character seems to be recessive to the normal form.

**XV. Germless seeds, M. Demerec.**—In germless seeds (*Gm*, *gm*), described as an inherited character, the endosperm is developed normally, but the embryo is almost or entirely lacking. Germless seeds were found in most commercial varieties of which selfed progenies were examined. The germless condition was found to be recessive to normal. Segregations in 63:1, 15:1, 3:1, and 9:7 ratios were observed, which is held to indicate the presence of at least four genetic factors for germless. Three of them are triplicate genes.



XVI. *Dead leaf margins*, J. H. Kempton.—Dead leaf margins, a character becoming noticeable about the time the tassel appears but before the flowers are mature, affects the upper 6 to 8 blades, usually embracing a leaf or two below the ear node. Crosses made between plants showing the dead margins character and 10 or 15 other aberrant forms gave indications that in addition to the character dead margins the progeny is affected with some lethal factor, as many of the hybrid seeds fail to grow. Four hybrids, grown successfully, all had normal leaves in the F<sub>1</sub> generation, while in the F<sub>2</sub> dead leaf margins reappeared in about 25 per cent of the plants. From an analysis of small progenies, dead margins seems to be unrelated genetically to brachytic culms, ramose inflorescence, sweet endosperm, sun red plant color, two factors for lineate leaves, and a chlorophyll disorder, yellow leaf spot.

**An effect of X-rays on the linkage of Mendelian characters in the first chromosome of *Drosophila***, J. W. MAJOR (*Genetics*, 8 (1923), No. 4, pp. 355–366, figs. 2).—A study has been made of the amount of crossing-over in the X-chromosome of the X-rayed and control stocks of *Drosophila* used in the experiments on nondisjunction previously described (E. S. R., 50, p. 226). The technique employed in treating the flies is more fully described here than in previous papers.

In the first experiment the doses given to the females before mating varied from 21 to 49 D (D equals a dose of 1 milliamperere at a distance of 10 cm. from the target during a time of 1 minute, furnished by a water-cooled Coolidge X-ray tube with tungsten target operated at 50,000 volts, root mean square, alternating current). The pairs of flies were allowed to remain in individual bottles for 6 days, after which they were changed to other bottles where they remained for 8 days. There was no significant difference between crossovers percentages of the offspring of the X-rayed and control females in the first bottles, but in the second bottles there were 28 per cent of crossovers in the controls and only 12 per cent of crossovers in the offspring of X-rayed females. The results also indicate that the crossover values decrease as the X-ray dose is increased.

In the second experiment 3 groups of flies were treated, the dose and the time in giving each varying as follows: Group 1 35 D treated for 3 minutes 17 seconds, group 2 38 D treated for 2 hours 15 minutes, and group 3 36 D treated for 20 hours 20 minutes. The flies in this experiment were transferred to new bottles every 3 days. The following table shows that the crossover values were in conformity with those of the first experiment:

*Crossover values of offspring from X-rayed and control flies.*

Group.	Eggs of X-rayed females laid during different periods after treatment.				Eggs of control females laid during different periods after treatment.			
	1-3 days.	4-6 days.	7-9 days.	10-12 days.	1-3 days.	4-6 days.	7-9 days.	10-12 days.
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
1.....	27.7	24.0	6.7	9.6	30.8	30.4	25.6	25.8
2.....	26.3	26.8	11.6	12.7	29.0	33.5	25.7	32.0
3.....	27.6	27.5	11.4	8.4	29.4	31.3	32.7	28.1

No evidence of a decrease in the crossover percentages was shown by the offspring of the daughters of the X-rayed females. In explaining the results, the author states that the seeming reduction in crossing-over may have been due to an increase in the amount of double crossing-over, since eosin and

miniature were the only two loci involved. The most peculiar phenomenon was that the X-ray dose lasting 3 minutes 17 seconds was operative on the eggs laid over a period of 6 days.

**Further data on webbed toes**, W. E. CASTLE (*Jour. Heredity*, 14 (1923), No. 5, pp. 209, 210, fig. 1).—More data on webbed toes (E. S. R., 48, p. 66) are presented, in which the abnormal condition occurred only in a part of the females in the pedigree given. The author suggests that if the usual method of transmission is in the Y-chromosome there has been a crossing-over of the gene to the X-chromosome. It is also stated that a simpler explanation would be that the character depends on a dominant gene located in an autosome.

**The mechanism and physiology of sex determination**, R. GOLDSCHMIDT, trans. by W. J. DAKIN (*London: Methuen & Co. Ltd.*, 1923, pp. VIII+259, pls. 6, figs. 107).—This book is an English translation of the work of Goldschmidt, with some revisions and additions by the author which have brought it up to date. The mechanism of sex determination is reviewed, but the greater portion of the book deals with intersexuality and the author's theory as to its cause, based largely on observations with the gipsy moth and much other biological evidence which has been presented by different investigators. Secondary sexual characters, hermaphroditism, and parthenogenesis and their relation to sex determinations are also discussed. Other chapters deal with sex ratios and sex determination in man.

**Studies in intersexuality.—II, Sex reversal in the fowl**, F. A. E. CREW (*Roy. Soc. [London] Proc., Ser. B*, 95 (1923), No. B 667, pp. 256–278, pls. 2, figs. 3).—A description of the anatomical and histological condition of the genital organs of eight fowls which have been transformed with greater or less completeness from females into males is given. The birds studied include a hen which laid eggs and hatched chickens, but which in later life was gradually transformed to a male which was able to fertilize the eggs of another hen when mated with her.

The histological studies of the gonads from these birds, in conjunction with Goldschmidt's theory of the effect of internal secretions in the production or alteration of sex, has aided the author in establishing a hypothesis for these cases. He suggests that during embryonic life the female-determining substances are in excess and oocytes are formed, but that at any time when conditions are unfavorable for the continuation of oocyte formation and growth, as might result through pathological conditions in the ovary or physiological exhaustion, spermatogenic tissue is differentiated in the ovary from the invading peritoneum and the animal takes on the characters of the male even to the production of active sperms.

A review of similar cases reported by other authors is also given. The previous study of this series has been noted (E. S. R., 50 p. 130).

**Histological studies on the gonads of the fowl.—I, The histological basis of sex reversal**, H. B. FELL (*Brit. Jour. Expt. Biol.*, 1 (1923), No. 1, pp. 97–130, pls. 3).—This is a report of the more detailed histological studies of the gonads of the eight intersexual fowls described by Crew as noted above.

**On different sex ratios in *Drosophila melanogaster***, G. BONNIER (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 31 (1923), No. 1–2, pp. 153–169, fig. 1).—Investigations of the action of lethal factors in modifying sex ratios in *Drosophila* are reported from the University of Stockholm. Individuals carrying the two lethal factors  $l_l$  and  $l_r$  (previously described)<sup>1</sup> in one X-chromosome were crossed with another strain carrying a third lethal factor  $l_t$ , and the

<sup>1</sup> Acta Zool., 3 (1922), No. 1, pp. 135–152.



exceptional females resulting when crossed to wild type males produced offspring having a sex ratio of 10 females to 1 male. The two factors  $l_l$  and  $l_r$  were shown in the earlier paper mentioned to produce sex ratios in the offspring of 2.21 females to 1 male. The lethal factor  $l_t$  is thought to kill the male embryos during an early stage in their development. A fourth sex-linked lethal factor is also described and approximately located in the chromosome at locus 63. By its lethal action on the females it produces an approximate sex ratio of 1 female to 2 males.

In discussing the primary sex ratio (sex ratio at conception) of *Drosophila*, the author has found that this ratio may be derived by the following equation:

$$100\sqrt{\frac{a}{b}}$$

In this,  $a$  equals the ratio of males to 100 females in regular, and  $b$  equals a similar ratio in exceptional, flies.

**On "maternal inheritance,"** H. UDA (*Genetics*, 8 (1923), No. 4, pp. 322-335, fig. 1).—The behavior of brown and normal slate egg color in silkworms in crosses made at the College of Agriculture, Tsu, Japan, is reported. The normal color was apparently dominant to the brown, but the  $F_1$  generation was always like the female parent, though the  $F_2$  eggs segregated in ratios of 3 normal to 1 brown whether the  $F_1$ s were brown or normal. They were thus apparently genotypically the same. The author offers the explanation that at this early stage in development the sperm characters had not had sufficient opportunity to influence the color of the eggshell. The results of other experiments are cited which tend to substantiate this explanation.

**Studies in inheritance in cotton.**—I, **History of a cross between *Gossypium herbaceum* and *G. neglectum*,** G. L. KOTTUR (*India Dept. Agr. Mem., Bot. Ser.*, 12 (1923), No. 3, pp. 71-133, pl. 1, figs. 7).—An account of the characteristics and behavior of a cross between a pure line of the Kumpta variety (E. S. R., 44, p. 829; 45, p. 634) of *G. herbaceum*, known as Dharwar No. 1, and a pure line of *G. neglectum rosea* isolated from the narrow-lobed, white-flowered type of Sholapur cotton. The parents were very similar as to general type of plant and seed weight, but had many contrasted characters. The characters considered in this study included color of the cotyledonary stalk, shape of leaf, color of flower, length of petal, presence of nectaries, ginning percentage, and length of staple. The correlation between ginning percentage and staple was also dealt with.

**Delayed germination and the origin of false wild oats,** R. J. GABER and K. S. QUISENBERRY (*Jour. Heredity*, 14 (1923), No. 6, pp. 267-274, figs. 2).—Experimental evidence presented in this contribution from the West Virginia Experiment Station indicates that, in hybrids between *Avena sativa* and *A. fatua*, delayed germination characteristic of wild oats is an inherited recessive character and that it is somewhat loosely linked with the fatua type of seed articulation. The fact that delayed germination was not found in seed from homozygous false wild, heterozygous false wild, or sativa plants seems to show that the origin of false wild oats (E. S. R., 48, p. 33) is more reasonably explained by mutations than by natural crossings.

**Oestrus, ovulation, and menstruation,** G. W. CORNER (*Physiol. Rev.*, 3 (1923), No. 4, pp. 457-482).—This is a comprehensive review of oestrus and ovulation, with the attending physiological changes in mammals and more especially with reference to their relation to the time of menstruation in the primates. The bibliography includes 81 references.

## FIELD CROPS.

**The law governing growth factors**, E. A. MITSCHERLICH, trans. by K. A. BONDORFF (*Nord. Jordbrugsforsk.*, 1922, No. 1, pp. 161-184).—This article is a translation into Danish of a lecture on the subject given by the author at a meeting of the Danish Scientific Society. Pot culture and field culture experiments are discussed with regard to the control of different factors affecting the results and to the probable error, together with its elimination. The various growth factors are considered with reference to their relative importance, and the numerical expression of their values is worked out and explained. In conclusion it is pointed out to what extent a determination of the values of soil and other growth factors is possible.

**[Soil reaction and plant development]**, O. ARRHENIUS (*Meddel. Centralanst. Försöksv. Jordbruksområdet*, No. 245 (1923), pp. 14, fig. 1).—Experiments were conducted in 1922 with 17 different field crops, the plants being grown in boxes, on soils given a definite H-ion concentration, ranging from pH 3 to pH 10 with unit intervals except from pH 6 to pH 8 where the intervals were only one-half.

The results, regarded as preliminary, indicated that while the soil reaction is an important factor in plant growth, the same H-ion concentration may show wide variations in plant production. Dwarfing of the plants occurred with a reaction of pH 3 to pH 4 and also when the concentration stood at pH 9 to pH 10, while chlorosis was generally associated with high alkalinity but occurred also on soils with acid reaction. The two H-ion concentrations giving the highest yields for a number of crops in the experiment were as follows: Dala oats pH 5 and pH 8, Rubin spring wheat pH 7 and pH 5, timothy pH 9 and pH 4, red clover pH 6 and pH 5, alfalfa pH 8 and pH 7, flax pH 4 and pH 6, and sugar beets pH 8 and pH 6. Most of the other crops under investigation showed similar variations.

**The effect of one crop on another**, R. W. THATCHER (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 8, pp. 331-338).—Review of experimental data revealed indications of a deleterious effect exerted by some crops upon others when grown together on the same land in the same season. Under certain unfavorable soil conditions as to soil acidity, an injurious effect upon the crop of a succeeding season may be produced by preceding crops. This is undoubtedly of a different order from the association effect and is probably due to a definite chemical effect upon certain elements in the soil, notably aluminum, and seems to be remedied by maintaining a neutral soil reaction. No positive proof of the nature of the causative agent or agencies for either the beneficial or the injurious effect of one crop upon another has appeared, and definite proof that observed injurious effects on a second crop are due to toxic chemical substances in the soil produced by or in association with the first crop has not yet been established.

**Field crops**, A. D. WILSON and C. W. WARBURTON (*St. Paul, Minn.: Webb Pub. Co.*, 1923, rev. ed., pp. 515, figs. 167).—In this edition of a work noted earlier (*E. S. R.*, 40, p. 622), statistics of acreage and production are brought forward as far as possible and other changes made which are believed to harmonize with the latest information.

**[Field crops work at the Alaska Stations]**, C. C. GEORGESON (*Alaska Stas. Rpt.* 1922, pp. 2-7, pl. 1).—Investigations reported on in continuation of earlier studies (*E. S. R.*, 49, p. 426) comprised varietal and field trials with spring and winter wheat, barley, oats, alfalfa, clover, sweet clover, and field peas. Notes are included on *Vicia cracca* and on oats, grasses, and other crops for



silage. Hybridization work with cereals, carried on by G. W. Gasser, is described briefly.

**Crops** (*Kans. State Bd. Agr., Bien. Rpt. 23* (1921-22), pp. 153-156, 169-184, figs. 3).—Articles of interest to the agronomist include Wheat Possibilities in Kansas, by H. M. Bainer; Sudan as a Pasture Grass, by P. W. Enns; Potato Raising in Kansas, by G. E. Kelsey; and Methods of Controlling and Eradicating Bindweed, by L. E. Call (*E. S. R.*, 49, p. 427).

[**Field crops work in Porto Rico in 1922**], T. B. McCLELLAND, T. BREGGER, W. P. SNYDER, and J. A. SALDAÑA (*Porto Rico Sta. Rpt. 1922*, pp. 4-6, 9, 10, 11).—The progress of earlier work is reported on (*E. S. R.*, 48, p. 226).

The effect of the length of day and consequently the season of planting was very pronounced on *Tephrosia candida*. Of eight species of *Crotalaria* compared, *C. juncea* at 2.5 months after seeding had the best development.

Key West led the sweet potato varieties, and S. P. I. No. 46801 was foremost among the yams. Staked yams gave a yield averaging 41 per cent greater than unstaked. Spacing tests were made with varieties of yautias and taros. Breeding work carried on with corn, rice, cowpeas, soy beans, and mungo beans is described briefly. In the progeny of a cross with black Venezuelan beans, blackness of the seed coat was found to be dominant over whiteness and glossiness over dullness.

[**Field crops investigations in the Virgin Islands, 1922**], J. B. THOMPSON (*Virgin Islands Sta. Rpt. 1922*, pp. 2-5, pl. 1, fig. 1).—Experimental work reported on in continuation of earlier work (*E. S. R.*, 48, p. 332) included the production and comparison of sugar cane seedlings and varieties; variety tests with cowpeas, soy beans, and sweet potatoes; and the development of a table corn resistant to the corn earworm (*Heliothis obsoleta*). A probable bud mutation in the Bigwig sweet potato is described. In growing sweet potato seedlings, unscarified seed germinated very irregularly, plants coming up from 3 to 75 days after planting.

[**Field crops work in Nova Scotia, 1922**], W. W. BAIRD and W. S. BLAIR (*Canada Expt. Farms, Rpts. Supts. 1922, Nappan (N. S.) Farm*, pp. 21-32, 37-39, 47-67, fig. 1; *Kentville (N. S.) Sta.*, pp. 15-21, 46-50, 55-66, fig. 1).—Investigations reported on comprise varietal trials with spring wheat, oats, barley, corn for silage, buckwheat, sunflowers, potatoes, mangels, carrots, swedes, and sugar beets; fertilizer tests with potatoes and on pasture meadows and marshland; seeding experiments with potatoes, alfalfa, sunflowers, miscellaneous forage crops, and mixtures for hay; cost studies; and rotations.

**Third report on the activities of the Agricultural Council [Denmark]** (*Beret. Landbr. Raadets Virks. [Denmark]*, 3 (1922), pp. 102+819, figs. 48).—The activities of the council for the year ended December 31, 1922, are briefly reviewed, and the commercial relations having a more or less direct bearing on the agriculture of Denmark are outlined, mainly in reports of the foreign service of the country.

**Experiments with grass mixtures at the Leteensuu (Finland) experiment station, 1907-1919**, E. F. SIMOLA (*Suomen Suoviljelysyhdist. [Finska Mosskulturför.] Tieteell. Julkaisu. No. 3* (1923), pp. 103+15, figs. 2).—Ten seed mixtures were seeded in 1906 on lowland moor, receiving from 100 to 400 cubic meters of loam and from 200 to 400 cubic meters of sand per hectare, and the hay yields and botanical composition of the plats from 1907 to 1913 are tabulated and discussed. In 1911, 11 grasses and mixtures were sown on a drained lowland moor where the water table was controlled by ditches with dams (*E. S. R.*, 42, p. 29). Yield and botanical data were obtained from 1912 to 1919, inclusive. Some of the plats in the second series were loamed

and others received from 1,000 to 3,000 kg. of lime per hectare (890 to 2,670 lbs. per acre).

Weather conditions had a very large influence on the annual yield and the quality of the hay. Raising of the water table by means of ditches with dams noticeably increased production. Addition of loam and sand to the land greatly affected the production and botanical composition of the hay, whereas the influence of lime was not so distinct.

In the experiment started in 1906 the total yield of the mixtures on loamed and unloamed moor varied between 3,778 and 4,813 kg. per hectare. A mixture of *Alopecurus pratensis* 5 kg., *Phleum pratense* 10, *Festuca elatior* 5, *Trifolium pratense* 7, *T. hybridum* 3, *Poa pratensis* 5, and *Cynosurus cristatus* 4 kg. gave the best yields. On sanded and unsanded lowland moor the yields varied from 3,887 to 5,298 kg. per hectare, with the same mixture leading. In the test started in 1911 on drained lowland moor the total yield varied during eight years from 5,509 to 7,215 kg., with a mixture of *Phleum pratense* 8 kg., *T. pratense* 6, *T. hybridum* 3, *Avena elatior* 4, *Anthyllis vulneraria* 2, *Lolium perenne* 4, *L. italicum* 5, *Bromus arvensis* 1, and *Medicago lupulina* 2 kg., giving best results.

*Alopecurus pratensis* persisted well in both series, being much better on the loamed lowland moor than on the unloamed. Sanding also favored its persistence. *P. pratense* behaved admirably in both tests. The first cutting was always good; the second, however, was not satisfactory in the first series. *T. pratense* was better in the first than in the second series and generally lasted much better on loamed and sanded lowland moor than on untreated land. *T. hybridum* did not equal *T. pratense*, but where the land had been treated its duration was much longer than without treatment. *Dactylis glomerata* was not satisfactory on untreated lowland moor, doing better on the sanded and loamed land. *F. elatior* persisted somewhat better than *D. glomerata* in the untreated land. *Poa pratensis* maintained itself well in the plats but increased rather slowly. *L. perenne*, *B. arvensis*, and *C. cristatus* behaved poorly in the first series and were worse in the second. They are not considered safe on lowland moor in the climate of Finland unless persistent stocks can be bred. *Avena elatior*, *L. italicum*, *B. inermis*, *T. repens*, *Lotus uliginosus*, *L. corniculatus*, *Vicia sepium*, *M. lupulina*, and *Anthyllis vulneraria* were of very limited duration in the test started in 1911. *T. pratense* from Scotland, *Anthoxanthum odoratum*, *Agrostis stolonifera*, and *Carum carui* were also rather low in persistence. Native *V. cracca* and *Lathyrus pratensis* maintained themselves fairly well in the series seeded in 1906. *Phalaris arundinacea* and *F. arundinacea*, each seeded alone, thrived well and produced, on the average, satisfactory first and second cuttings.

Adventitious grasses found in the greatest numbers in some mixtures on the unloamed moor were *F. rubra*, *F. ovina*, *A. vulgaris*, *A. stolonifera*, *Poa pratensis*, *P. serotina*, *Aira caespitosa*, and *Calamagrostis stricta*. Weeds appearing in the plats are listed. Their growth in meadows at this station has been noted earlier (E. S. R., 38, p. 141). In making up a mixture for lowland moor, it is held that the height of the water table, cultural conditions of the soil, and the amount of ameliorants should be taken into account. Native persistent legumes and grasses above all should be chosen, together with introduced plants that have proved themselves persistent.

**Fibers** (*Bul. Imp. Inst. [London], 21 (1923), No. 1, pp. 37-41*).—Fibers received by the Imperial Institute from British possessions and reported on for properties and uses include manila hemp (abaca), flax, sisal, cotton, kapok, flosses, and silk.



**Growing alfalfa in Montana**, E. N. BRESSMAN (*Montana Sta. Circ. 116* (1923), pp. 30, figs. 22).—A practical discussion of methods of growing and handling the crop for hay, pasture, and seed under irrigation and dry-land conditions in Montana. See also earlier notes (E. S. R., 49, p. 430; 50, p. 134).

**The popping of pop corn** (*New York State Sta. Rpt. 1923*, p. 32).—The most important conditions affecting the popping of pop corn were found to be variety, moisture content of the corn, and temperature of the popper. Varieties with small flinty kernels pop best. The highest popping yields were obtained from corns having from 13.5 to 14.5 per cent of moisture.

The poor quality of pop corn sold in bulk at groceries is held due in part to the use of coarse, inferior varieties and to storage where it is too dry. During winter and spring an open shed is a good place to store pop corn, whereas in hot, dry summer weather a few days' storage in an ice box will improve the popping quality.

**Establishing and maintaining a desirable staple in cotton**, R. R. CHILDS (*Ga. Agr. Col. Bul. 288* (1923), pp. 12, figs. 4).—Variety tests by the Georgia College of Agriculture (E. S. R., 44, p. 635; 47, p. 632; 48, p. 530) showed conclusively that, where the average of several years is considered, early small boll cottons with inferior staple do not produce as much lint per acre. The acre value is also less than can be obtained from well selected seed of the medium-early large boll varieties such as College No. 1 and Cleveland, which usually possess desirable staples.

A survey among cotton mills in the State showed short and mixed staple to be the principal defects in Georgia cotton observed by the spinners. Boll weevil stains, weak staple, poor ginning, and uneven grades were other defects noted. Although the bulk of the cotton used in the State has a staple of from  $\frac{3}{8}$  to 1 in., 1 and  $1\frac{1}{8}$  in. staple appears to be in greatest demand not only in Georgia but in all other sections. Strict middling and middling cotton appear to be the grades in greatest demand, with only a slight variation in the grades used and those preferred. The premium for the better grades will often more than pay for any extra expense of picking as soon as open and eliminating as much trash and tinged cotton as possible. Cotton improvement, methods of selection, and community production are also discussed.

**Cotton trials at the irrigation experiment orchard, Berri, season 1921-22**, G. QUINN (*So. Aust. Dept. Agr. Bul. 169* (1922), pp. 12).—Cultural and varietal trials and cost studies show that cotton will thrive in the irrigated areas of the Murray Valley, producing lint of very high quality. Pima cotton appeared to be suitable for growing commercially in conjunction with irrigated fruits and vines.

**Equilibrium moisture of cotton**, T. FUWA and A. P. GODBOUT (*Textile World*, 64 (1923), No. 20, pp. 53, 55, figs. 2).—The equilibrium moisture for three kinds of natural cotton yarn, and of yarn baked for five days at 160° C. (320° F.), was studied, the equilibrium points being obtained by a progressive dehydration of the saturated cotton to dryness, and then by hydration to the original point of saturation. Preliminary experiments had indicated that the moisture regain of cotton at any given percentage of relative humidity varies considerably, depending upon whether equilibrium is approached from a dry sample or from one saturated with water vapor.

The equilibrium moisture for cotton is best expressed by a narrow hysteresis loop and not by means of a single curve, as is indicated by the data of Harts-horne and others. The equilibrium moistures of Arizona and Egyptian cottons are identical, and that of Peeler cotton is substantially the same under like conditions, being somewhat lower than the other two. Preliminary baking

for five days at 160° somewhat lowers the equilibrium moisture, probably due to a change in the fiber structure with heating.

**Flax in technical literature**, A. BROSCHE (*Der Flachs in der Fachliteratur*. Berlin: Verband Deutscher Leinenindustrieller, 1922, pp. 86).—A comprehensive bibliography of flax culture and processing in Germany and other countries, with titles dating from 1545 to the present time, is presented, together with an introduction to the history of German flax husbandry and with cultural rules, maxims, and traditions concerned in flax production.

**Seed potatoes** (*Science*, 58 (1923), No. 1502, p. XII).—New seed potatoes cut as usual and then dipped into a weak solution of sodium nitrate (3.5 lbs. to 10 gal. water) for from 30 to 60 minutes shortly before planting will sprout as quickly as seasoned seed, according to results of J. T. Rosa of the University of California. Seed treated by this method in an experiment started February 23, 1923, came up quickly with nearly a 100 per cent stand by April 3, whereas untreated seed was much slower in emerging and did not show a full stand until April 21. The treatment was found to be useless unless the tubers were cut before dipping in the solution.

**Certified seed in Irish potato production**, A. M. MUSSER and C. A. LUDWIG (*South Carolina Sta. Bul.* 218 (1923), pp. 16).—In cooperative tests in four counties in South Carolina in 1922 and 1923, certified seed potatoes gave average increases over noncertified seed of 10.2 bbls. per acre and 14.6 per cent in stand. No one source of seed proved superior to the others in source of seed tests in 1921 and 1922. The importance of seed-borne potato diseases is pointed out.

**Rice in Malaya**, H. W. JACK (*Fed. Malay States Dept. Agr. Bul.* 35 (1923), pp. [2]+II+96, pls. 21; also in *Malayan Agr. Jour.*, 11 (1923), Nos. 5, pp. 103-119, pl. 1; 6, pp. 139-169, pl. 1; 7-9, pp. 168-212, pl. 1).—A rather detailed account of rice production in Malaya, discussing distribution and areas, irrigation, soils, cultural methods and field practices, yields, harvesting, methods of milling, pests and diseases, economics of rice production, varieties, correlations (E. S. R., 44 p. 436), fertilizers and green manures, catch crops, experimental error (E. S. R., 48, p. 733), and improvement of the rice crop.

**On the probable error in variety trials with paddy**, B. N. SARKAR (*Agr. Jour. India*, 18 (1923), No. 5, pp. 475-486, pls. 2).—The investigations dealt with show that unless particular care is taken, variation of soil fertility may so affect yields of rice that the results of comparative variety trials may be misinterpreted. So far as the estimation of probable error (and the accuracy of the results) is concerned, the effect of this variation can be minimized by reducing the distance between the centers of the experimental plats to 4 ft. and by comparing adjacent plats only. The relative accuracy of methods of comparing adjacent plats is also discussed.

**Time for testing mother beets**, D. A. PACK (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 3, pp. 125-150).—Failure to recognize the erratic variations between tests of sugar beets at harvest time and after storage until spring has probably led to confusion in the selection of desirable strains of sugar beets in breeding work. According to data given in this contribution from the sugar plant investigations of the Bureau of Plant Industry, U. S. D. A., spring tests of sugar beets made after storage are not comparable with tests made at harvest, being untrustworthy and giving erroneous values for the quality of the beets at harvest. Individual beets show great irregularity in the percentage and quality of sugar lost during storage. Beets high in sugar and sugar content tend to lose more sugar during storage than do beets which are low in sugar and sugar content.



Since sugar beet factories cut their beets at harvest or within an average period of storage of about 40 days, strains selected as desirable for breeding purposes should be considered on the basis of fall rather than of spring tests. To understand clearly the comparative value of different strains of beets, the plant breeder should record both fall and spring tests and the conditions under which the beets were stored.

**Cane experiments in the Philippines**, N. B. MENDIOLA (*Sugar [New York]*, 25 (1923), No. 11, pp. 602-604).—Breeding work with sugar cane in the Philippines is reviewed briefly, with descriptions of selected seedlings and notes on resistance to Fiji disease and a feeding test with canes of the Uba type.

**[Experimental work with tobacco in Canada in 1921 and 1922]**, F. CHARLAN, J. E. MONTREUIL, D. D. DIGGES, and H. A. FREEMAN (*Canada Expt. Farms, Tobacco Div. Interim. Rpt. 1921*, pp. 1-52, figs. 3; *Rpt. 1922*, pp. 58, figs. 6).—The progress of earlier work (E. S. R., 46, p. 836) is reported. Varietal work at the Central Farm concerned yields, disease resistance, and fermentation studies. Cooperative trials involved comparisons of broadcasting v. drilling fertilizer, different fertilizer formulas, distances of spacing with heavy applications of fertilizer, the effect of different sources of nitrogen on the yield, color, and quality of tobacco, the use of tobacco stems with acid phosphate for fertilizer, and miscellaneous tests.

Tobacco seedlings were produced at Farnham, Que., at a cost of \$1.215 per 1,000 in 1921 and \$1.15 in 1922, and tobacco at \$259.63 and \$199.67 per acre, respectively. Pointed laths were preferred to laths with wire nails.

Seed-bed studies at Harrow, Ont., demonstrated the superiority of the glass covered semihotbed and the value of black compost for top-dressing and making the bed in the fall with 30 minutes' steaming at 100 lbs. pressure for weed and disease control. On a fairly fertile soil with enough humus, a weak solution of sodium nitrate may be applied when the leaves are the size of a small coin. The rate of seeding should be governed by the germinative power of the seed, the flue-cured varieties being seeded more thinly than Burley.

Considering both yield and color, a 4-year rotation of corn, tobacco, cereal, and grass was best for flue-cured, and a 5-year rotation of tobacco, corn, cereal, and grass (two years) for Burley. On land slightly infested with root rot, a good 4-year rotation omitting red clover will apparently eradicate the disease. Despite heavy applications of manure and fertilizer, continuous tobacco showed marked decreases in yield and quality and increases in mosaic and rusts. Fall plowing for Burley gave higher yields and is deemed more economical than spring plowing. Closer planting of both flue-cured and Burley resulted in gains in yield and quality.

Splitting the stalk at harvest resulted in an improved color and quality and hastened curing about 10 days. Scaffolding was slightly superior to piling in the field in that the leaves did not become so compacted, the rate of yellowing was more uniform, and the more exposed leaves did not appear to become weatherbeaten so soon. In fair weather tobacco may be either piled or scaffolded to advantage for not over 3 days, thereby conserving barn space, lessening the danger of pole burn and strutting, and facilitating a more rapid cure.

The Johnson tobacco-curing furnace did not appear to be practical under the existing conditions. Satisfactory results were obtained by flue-curing tobacco with steam heat. Observations on the relation of the relative humidity in the curing barn to the color of the cured leaf indicated that for a medium-sized, rather sapless crop produced in a dry season, and for a somewhat heavy sappy tobacco, respectively, the relative humidity should be about 79 and 70 per cent when the bottom leaves begin to yellow, 72 and 62 when the middle leaves begin

to yellow, 60 and 52 when the tips begin to yellow, and 47 and 40 per cent when the tobacco is yellow enough to begin fixing the color. With still heavier bodied tobacco the rate of decrease should be a little faster than recommended above. The best results were obtained with tobacco which was well ripened, not over-ripe, and which had faded out to a yellow color before being harvested.

**The nicotin content of the leaf and smoke of untreated domestic tobacco,** H. RHODE (*Ztschr. Untersuch. Nahr. u. Genussmitl.*, 45 (1923), No. 2, pp. 112-115).—Three lots of tobacco prepared by simply drying the plant contained respective percentages of water of 10, 16.3, and 17.4; and, based on dry weight, nicotin 1.28, 1.04, and 0.77, and ash 37.14, 29.22, and 33.49. The respective percentages of a heavy commercial and a light commercial tobacco were water 11.8, 9.3, nicotin 2.37, 0.68, and ash 17.62, 23.86. The ash content of the untreated tobacco was so high that this tobacco only charred at the temperature of the pipe, whereas the commercial tobacco was completely consumed. The smoke from the untreated tobacco contained more nicotin than that from the commercial tobacco.

**Turkish tobacco culture, curing, and marketing,** W. T. CLARKE (*California Sta. Bul.* 366 (1923), pp. 637-676, figs. 18).—Practical instructions deal with varieties of Turkish tobacco, improvement through selection, environmental needs of the crop, cultural and field practices, curing methods, and pests. Fermentation, grading, and marketing are discussed by A. Aram. D. S. Neuman reviews briefly the introduction of tobacco into southern Europe, indicates the components of nicotin, and gives his methods for bagging blossoms of selected plants and for handling leaves prior to curing.

**Blackhull wheat,** L. E. CALL and J. H. PARKER (*Kans. State Bd. Agr., Bien. Rpt.* 23 (1921-22), pp. 184-192).—Blackhull wheat was selected by E. G. Clark of Sedgwick, Kans., from a field of Turkey. Blackhull can usually be identified by the bluish-black color of the glumes. The leaves and stems grow more upright than those of Kanred and Turkey and are of a slightly different shade of green. The plants are characterized by vigorous growth when wheat first becomes active after the winter rest period.

Experiments and observations by the Kansas Experiment Station and others indicate that Blackhull under some conditions may be described as rust-escaping, but not resistant to red leaf rust, nor is it known to resist black stem rust. Blackhull seems to have a slightly stiffer straw than Turkey or Kanred and is not so likely to lodge on rich ground and in wet seasons. The variety usually tests from 1 to 4 lbs. heavier per bushel than Kanred and other hard winter wheats grown under the same conditions.

Blackhull is ordinarily classed as a hard red winter wheat, although it somewhat resembles the soft red winter wheats in milling behavior (E. S. R., 48, p. 136). Some bread made from Blackhull wheat has been fully equal to that from Kanred and Turkey, while in other cases it has been inferior.

In experiments from 1919 to 1922, inclusive, Blackhull wheat has generally outyielded Turkey and Kharkof and has averaged about the same as Kanred. Experiments at the Colby Substation and in cooperation with the U. S. Department of Agriculture gave evidence that it is not as winter-hardy as Turkey and Kanred and should not be grown in the northwestern corner of the State, or in other sections of Kansas or in other States where winter-hardiness is of primary importance.

**Wheat on the Arctic Circle,** C. K. MICHENER (*Northwest. Miller*, 136 (1923), No. 5, pp. 461, 462, 477-480, figs. 8).—A discussion of the possibility of wheat production in northern Alaska, based mainly on work of the Alaska Experiment Stations.



**Wheat, J. H. RICARD ET AL.** (*Le Blé. Compte-Rendu des Travaux de la Semaine Nationale du Blé. Paris: Imp. Dubois & Bauer, 1923, pp. 607+IV, pls. 7, figs. 89*).—A comprehensive report of National Wheat Week held at Paris from January 23-28, 1923, is presented. The numerous papers included deal with the production, milling and baking, and commercial movement of wheat, particularly with regard to France and North Africa.

**The Seeds Act, 1923, with the regulations made by the minister of agriculture** (*Ottawa: Canada Dept. Agr., Seed Branch, 1923, pp. 27*).—The text of the Canadian law governing the testing, inspection, and sale of seed is set forth, together with regulations and the personnel of the advisory board provided for.

**The eradication of bindweed, L. E. CALL and R. E. GETTY** (*Kansas Sta. Circ. 101 (1923), pp. 18, figs. 10*).—A popular description is given of the bindweed (*Convolvulus arvensis*), said to be the most destructive weed found in Kansas, with discussion of its manner of dissemination, distribution in Kansas, injury to crops, and methods for control and eradication. Small patches of bindweed can be destroyed by salting, continuous cultivation, and continuous cultivation accompanied by pasturing with hogs. The use of alfalfa and sorghum as smother crops (*E. S. R., 49, p. 427*) is deemed a promising method for destroying large areas of the pest.

## HORTICULTURE.

**[Horticultural investigations at the Alaska Stations], C. C. GEORGESON** (*Alaska Stas. Rpt. 1922, pp. 10-13*).—A brief progress report (*E. S. R., 49, p. 434*), in which breeding work with strawberries is again reviewed (*E. S. R., 50, p. 140*), and acclimatization and testing work with various vegetables, fruits, and flowers, are discussed. The Yellow Transparent apple, Petrowski turnip, and the Japanese rose (*Rosa rugosa*) have shown merit for Alaskan conditions. The apple, however, does not usually mature except in very favorable seasons.

**[Horticultural investigations at the New York State Experiment Station]** (*New York State Sta. Rpt. 1923, pp. 43-47*).—Similarly to that of the preceding year (*E. S. R., 49, p. 38*), this report contains brief progress notes upon investigational activities.

Grape pruning experiments at Fredonia and Urbana (*E. S. R., 43, p. 341*) continued to show that the Kniffen four-cane system of training is the best practice in both localities. As indicated by studies which have extended over a period of 12 years, the age of the apple tree at time of planting has no material effect on the vigor or productivity of the future tree, nor upon the quality of the fruit; nevertheless, it is believed that a 2-year tree has some advantages over either the 1- or the 3-year-old. Results of plum stock experiments are again cited (*E. S. R., 49, p. 340*). The season's results in the Rome Beauty orchard substantiated those of previous years (*E. S. R., 42, p. 344*), namely, that nitrogen, phosphoric acid, and potash are of no benefit on the soil type utilized in the experiment. Fertilizer experiments in vineyards at Fredonia and Urbana showed that while nitrogen, phosphoric acid, and potash all have a beneficial effect on growth of vine, yield, and quality of fruit, nitrogen alone is sufficiently valuable to warrant its purchase by grape growers. Incidental to a test of melon and cucumber varieties, it was discovered that wire screen protectors used for excluding insects have, independent of insect control, a beneficial effect on the vigor of the plants.

**[Horticultural investigations at the Porto Rico Station, 1922], T. B. McCLELLAND, T. BREGGER, W. P. SNYDER, J. A. SALDAÑA, and H. C. HENRICKSEN**

(*Porto Rico Sta. Rpt. 1922*, pp. 6-8, 10, 11, 12, 13, 15, 16, pl. 1, figs. 4).—A progress report upon experimental activities of the year (E. S. R., 48, p. 234).

An unusually heavy crop of mangoes gave an opportunity to study some of the newer and more promising varieties, such as *Mekongensis*, *Chempadan*, *Fernandez*, and *Itamaracá*. In a fertilizer test with 8-year-old coconut palms, common salt gave larger yields than did any other treatment. The yield of coffee was apparently more affected by nitrogen and potash than by phosphoric acid. The source of nitrogen was found to be especially important, as indicated by the fact that trees fertilized with ammonium sulphate made larger trunk growth and yielded 72 per cent more berries than did similar trees fertilized with nitrate of soda. *Excelsa*, the best of the Liberian coffees so far tested, is deemed very promising for certain sections of the island where the leaf miner severely damages the Arabian types.

F<sub>1</sub> generation eggplants resulting from a cross between New York Improved and the native striped *Pompona* yielded fruits intermediate in size between the two parents. Observations on the F<sub>2</sub> generation of sweet corn hybrids between Henderson Sugar and a native white field variety showed 131 of 196 to be vigorous and comparatively fruitful. The progenies of a number of individual wilt-resistant tomato plants grown on soil on which wilt was prevalent the preceding year, contained some plants showing apparent resistance. *Prolific* × *Stone* and *Globe* × *Prolific* produced fruits, some of which weighed 1 lb. or more. Third and fourth generation plants of a native muskmelon crossed with *Salmon Tint Pollock* and with *Hybrid Casaba* yielded fruits having both soft and hard rinds. Banana plants selected for resistance to the Panama disease made slightly more vigorous growth than did unselected plants. Tobacco stems and wood ashes had no apparent effect upon this disease.

Laboratory tests of various gases as media for hastening the coloring of citrus fruits yielded interesting results. It was found that practically all gases may produce spotting of the skin when they strike the fruit with some force, and that such spotting may occur when chemically active gases, such as chlorine or sulphur dioxide, are allowed to settle on the fruits. Vapors of ether, chloroform, or ethylene imparted an odor to the fruit. Loosening of the stems, resulting in *Diplodia* decay, may occur when fruit is exposed for considerable time to any gas except oxygen. In fact all vapors or gases should contain ample oxygen to provide for unhindered respiration. It is suggested that the coloring chambers be provided with artificial air circulation provided by means of electric fans.

**Horticultural investigations [at the Virgin Islands Station], J. B. THOMPSON** (*Virgin Islands Sta. Rpt. 1922*, pp. 5-10, pls. 2).—A large number of species and varieties of vegetables were tested during the year with varying degrees of success. Pole beans were generally more productive and drought resistant than were bush varieties. Red and White Bermuda onions were successfully grown on St. Croix Island, indicating the possibility of developing a commercial enterprise.

**The small nursery, N. Coon** (*New York: A. T. De La Mare Co., Inc., 1923*, pp. VIII+125).—A small handbook devoted to the economic considerations involved in the establishment of a small nursery. Appended are articles on cost finding and on horticultural standards, the latter containing shipping and trading terms, abbreviations, telegraph codes, etc.

**The fruit industry in New York State** (*N. Y. State Dept. Farms and Markets, Agr. Bul. 147 (1922)*, pp. 344, figs. 52).—This is a revised and greatly abridged edition of an earlier noted bulletin (E. S. R., 35, p. 836).



**The planting and early care of the commercial apple orchard, J. OSKAMP** (*N. Y. Agr. Col. (Cornell) Ext. Bul. 75 (1923), pp. 43, figs. 27*).—Prepared in a general way for the benefit of prospective apple planters in the State of New York, there has been incorporated in this publication the latest knowledge attained as a result of scientific work throughout the country. Particular attention is paid to selection of the site, varieties, pruning, soil management, and fertilization.

**Studies in apple storage, II, J. R. MAGNESS and A. M. BURROUGHS** (*In Storage Investigations, 1921-1922. Canton, Pa.: Marble Lab., Inc., 1923, pp. 17-98, pl. 1, figs. 20*).—This further contribution from the Marble Laboratory, Inc. (*E. S. R., 49, p. 39*), is prepared in two parts, the first of which, entitled *The Storage of Apples as Influenced by Temperature, Humidity, Ventilation, and Type of Package*, deals with miscellaneous experiments conducted with eastern and western grown apples held in natural and in ventilated and nonventilated cold storage.

Hardness tests conducted with the Murneek pressure apparatus indicated that apples pass through a distinct softening process following picking when hard ripe. After a period this softening practically ceases, and the fruits tend to remain nearly of the same texture until decay sets in. The pressure tester is believed to be reliable only when a considerable number of apples of each sample are included. Long keeping varieties, such as Winesap and Yellow Newtown, softened less rapidly than did early maturing varieties. Tests made of pared apples gave more satisfactory readings than did those of unpared fruits.

Apples held at 35° F. softened about one-half as rapidly as those held in common storage at 40°, and much more rapidly, except in the case of Yellow Newtown, than apples held at 32°. No consistent effect of ventilation could be detected in the rate of softening or ripening of apples held at 32°. The type of package had no significant effect on the rate of softening, which is believed to be mainly, if not entirely, subject to temperature. It is pointed out that the ripening of apples, especially early maturing varieties, may be delayed by prompt storage at 32°. Arranged in ascending order for toughness of skin are listed Baldwin, Jonathan, Spitzenberg, York, Delicious, Winesap, Rome, and Yellow Newtown. Toughness of skin increased after the apples were placed in storage.

A wide variation was noted in the wilting tendency of varieties, the Delicious, Rome, Winesap, and Yellow Newtown withstanding low humidity, while Jonathan, York, Baldwin, and Spitzenberg wilted and shriveled badly in similar environments, especially if stored in open receptacles. From data obtained in the various rooms, it was apparent that about 85 per cent humidity is necessary to prevent wilting of susceptible varieties stored in open containers, while fruit in barrels or wrapped in paper did not wilt seriously at 80 per cent. Humidities of 90 per cent or above induced formation of mold.

Observations on scald development in the various environments showed distinctly more scald developing under conditions of high humidity and continued ventilation than under conditions of lower humidity and no intake of outside air. In respect to package, the largest amount of scald occurred in barreled fruit. In the experimental environments, none of which are thought quite comparable to ordinary commercial storage, Winesap, Jonathan, Delicious, and Spitzenberg did not scald to any appreciable amount, York scalded badly, and Baldwin, Rome, and Yellow Newtown showed moderate injury. Conditions tending to promote wilting of fruit tended to reduce scald injury. Since soft scald was prevalent on Rome and Jonathan in both ventilated and nonventilated 32° rooms, entirely lacking in the cellar, and rare in the 35° chamber, the authors

believe that soft scald is associated with low temperature, which at one time dropped to 26°. General decay of fruit was most prevalent in the ordinary cellar and in the 35° ventilated room. In respect to package, the least amount of decay was observed in fruits wrapped in either plain or oiled paper and stored in boxes.

Part 2, entitled *Physiological Studies on Apples in Storage*, deals with the results of respiration tests and chemical analyses. Determinations of the rate of CO<sub>2</sub> evolution in Baldwin and Winesap apples in the various storage chambers and at different periods in the storage season showed the respiration rate of Baldwin to be slightly higher at all temperatures than that of Winesap. The rate of CO<sub>2</sub> evolution was so slow in both varieties at 32° that it could not be accurately measured. Analyses of samples of gas from within Baldwin apples showed an increase in the percentage of CO<sub>2</sub> and a decrease in O<sub>2</sub> correlated with increased storage temperature. The O<sub>2</sub> content of fruits at low temperature was only slightly below that of the outside air, whereas at 65° the quantity was much lower, accompanied by a marked increase in CO<sub>2</sub>.

Differences between varieties in respect to gaseous content are believed to be due partly to differences in the permeability of the skin to gases. Winesap apples dipped in a nondrying oil failed to soften normally and were low in O<sub>2</sub> content as compared with control lots. At 32° bruised Winesap apples gave off CO<sub>2</sub> practically twice as fast as did normal or slightly cut fruits. However, at 65° cut fruits respired more rapidly than bruised or normal specimens. From tests of the effect of various degrees of wounding under conditions of high humidity, the authors conclude that any injury markedly increases the rate of CO<sub>2</sub> evolution. The O<sub>2</sub> supply may within limits be a limiting factor in CO<sub>2</sub> evolution, yet, if the O<sub>2</sub> supply reaches a minimum, anaerobic respiration will occur, so that the total CO<sub>2</sub> evolved is not greatly reduced.

Determinations of the catalase activity in the flesh of Baldwin and Winesap apples from the different storage environments showed in almost every instance a great increase following the removal of fruits from cold storage to 65°. Catalase activity apparently followed respiration and appeared associated with total respiration rather than with the rate at any particular time.

Determinations made at intervals through the storage season of titratable acids in Baldwin and Winesap apples showed a rapid loss in the Baldwin and a moderate loss in the Winesap during the storage period, the losses being directly proportionate to the temperatures at which the fruit was stored. Sugar content was much less affected by storage environments than was acidity, a steady increase for a few weeks being followed by a reduction so slow that it was scarcely detectable. The highest aroma and flavor was found shortly after picking in those fruits held at from 60 to 70°. In long continued cold storage, aroma gradually decreased without attaining the maximum degree. In general conclusion, the authors discuss the results of the investigation and point out their relation to practical storage problems.

**Studies in apple storage, III,** A. M. BURROUGHS (*In Storage Investigations, 1921-1922. Canton, Pa.: Marble Lab., Inc., 1923, pp. 99-138, figs. 9*).—This paper, entitled *Certain Physiological Changes Taking Place during the Ripening of Wealthy, Wagener, and Baldwin Apples*, is a detailed report upon previously noted work (E. S. R., 50, p. 441).

**Studies in apple storage, IV,** L. M. MARBLE (*Canton, Pa.: Marble Lab., Inc., 1923, pp. 39, pl. 1, figs. 6*).—A general report, in which the author for the most part reviews previously noted investigations. He places emphasis upon the point that, where 32° immediate cold storage is unavailable, late fall and winter apples should be held in the open under sufficient cover to protect from the sun and rain but exposed thoroughly to the air until settled cold



weather begins. Observations are given upon the storage behavior of apples brought directly from the Pacific Northwest.

**The pineapple pear**, J. G. WOODROOF (*Georgia Sta. Bul.* 142 (1923), pp. 77-105, figs. 8).—Information is presented relating to the botany, history, and blight resistant qualities of the Pineapple pear, supposedly a hybrid between the European pear (*Pyrus communis*) and the Oriental pear (*P. serotina*).

This pear is unique in that it can be readily propagated in sandy soils from cuttings. Its blight-resisting ability was shown in a test in which this variety was planted among a large number of common and resistant varieties. After 10 years of growth all the Pineapple pears were recorded as vigorous, showing no blight, and producing fair crops of fruit, whereas practically all the better known varieties were dead or badly blighted. Pineapple pear scions grafted on common varieties remained healthy, while the rest of the tree was diseased. The inoculation of flower clusters of the Pineapple pear with a pure culture of pear blight organism (*Bacillus amylovorus*) resulted in the death of the flowers, but in no case did the infection pass back into the older wood. Inoculation of young twigs gave a similar result.

**Peach breeding at the New Jersey Agricultural Experiment Station making real progress**, M. A. BLAKE and C. H. CONNORS (*N. J. State Hort. Soc. News*, 4 (1923), No. 4, pp. 2, 3, 6, 7).—A comprehensive review of work to date, discussing the purposes, methods, and material utilized or available for use, and describing certain of the more promising seedlings, one of which, recently designated as Pioneer, is now being disseminated to the fruit growers of the State.

**Raspberries, blackberries, and dewberries**, J. OSKAMP (*N. Y. Agr. Col. (Cornell) Ext. Bul.* 64 (1923), pp. 16, figs. 6).—General information is presented relative to planting, propagation, fertilization, pruning, harvesting, varieties, diseases and insects, control, etc.

**A new method of grafting**, T. R. ROBINSON (*Jour. Heredity*, 14 (1923), No. 9, pp. 398-404, figs. 7).—An illustrated paper describing a modification of the Morris proximal slot graft, successfully used in Florida for the propagation of various subtropical fruits, including citrus, avocado, and mango. The modification of the original practice consists in fastening the scion to the stock with a fine brad instead of wrapping with cloth.

**A journey to the walnut sections of Europe and Asia**, C. THORPE (*Los Angeles: Author*, 1923, pp. [5]+101, pls. 24).—Interpolated with notes on the countries and the peoples residing therein, information is presented on the status of Persian walnut culture in China, France, Italy, etc.

**House plants and how to grow them**, P. T. BARNES (*Garden City, N. Y.: Doubleday, Page & Co.*, 1923, pp. X+242, pls. 31).—A general discussion prepared for the amateur grower.

## FORESTRY.

**Common forest trees of Kentucky: How to know them**, W. R. MATTOON (*Frankfort, Ky.: State Dept. Agr.*, 1923, pp. 72, figs. 70).—Similar to that for the District of Columbia (*E. S. R.*, 50, p. 241), this pocket manual, prepared in cooperation with the U. S. D. A. Forest Service, describes 70 common forest trees of Kentucky and gives notes on the value of the wood. Drawings of the twigs, leaves, and fruiting parts accompany the description of each species.

**Common forest trees of Georgia: How to know them**, W. R. MATTOON and T. D. BURLEIGH (*Ga. Agr. Col. Ext. Bul.* 291 (1923), pp. 80, figs. 78).—Similar to the above, this pocket manual describes 78 common forest trees of Georgia.

**Twenty years' growth of planted Norway, jack, Scotch, and white pine in north-central Minnesota**, J. H. ALLISON (*Jour. Forestry*, 21 (1923), No. 8,

pp. 796-801).—Observations upon pure and mixed plantings of white, jack, Scotch, and Norway pines located at the North Central Substation, Grand Rapids, gave certain indications, despite the ravages of a forest fire which swept over the entire plantation, of the comparative value of the four species. Norway and jack pines, apparently, were best suited to the soil, described as of a rather poor quality. In addition these species satisfactorily withstood droughty periods, and showed a capacity of producing a mean annual growth during a period of from 40 to 50 years of at least 0.75 cord per acre. Scotch pine started off well but developed poor form. The white pine suffered severe weevil injury and, consequently, made a poor start. Hence, it is recommended that plantings be confined largely to the Norway and jack pines, and that in pure stands there should be from 300 to 400 jack and from 500 to 600 Norway pines per acre at the age of 20 years.

**Current growth in Norway pine,** T. S. HANSEN (*Jour. Forestry*, 21 (1923), No. 8, pp. 802-806).—Measurements taken in 1922 in a mixed stand of Norway and jack pine, the average ages of which at the time of the establishment of the plats in 1912 were 88 and 86 years, respectively, showed the Norway pine to have made considerably less growth during the 5-year period ended 1922 than during the preceding 5 years. Since the Norway pines were in good physical condition and were 12 years below the estimated age at which current annual growth culminates, the author believes this retarded growth to have been due to some external and unexplained factor, such as rainfall, etc. Jack pine, on the other hand, was found to be in a decadent stage, and should have been removed from the stand some years previous.

**Relative susceptibility of incense cedar and yellow pine to bole injury in forest fires,** H. G. LACHMUND (*Jour. Forestry*, 21 (1923), No. 8, pp. 815-817, fig. 1).—A study based on 141 yellow pines and 45 incense cedars, scattered over two plats aggregating about 5.5 acres in area, showed the incense cedar to have not only a higher percentage of fire-injured trunks (87 per cent as against 69 for the pine), but also to have scars of a more serious character. It is believed that the differences in susceptibility to fire injury are due largely to differences in structure and composition of the wood and bark. In addition, a roundheaded borer was found to be extending the injuries in the incense cedar to the healthy tissue surrounding the wounds.

**The importance of duff moisture content in the forest fire problem,** H. T. GISBORNE (*Jour. Forestry*, 21 (1923), No. 8, pp. 807-809).—Without presenting data, the author states that studies at the Priest River Forest Experiment Station, Idaho, indicate that the top 0.25 to 0.5-in. layer of duff is sufficiently responsive to atmospheric moisture conditions to serve as a satisfactory indicator of increasing inflammability. This fact is considered doubly important in that the duff itself is an important receiver and carrier of forest fires, especially in white pine stands.

**Forest fires in Connecticut, 1910-1922, inclusive,** A. F. HAWES (*Hartford: State Forester*, 1923, pp. 28, pls. 4).—Information is presented relative to the location, extent, and cause of fires, forest fire legislation, equipment, organization, associations, etc.

**The hundred and first report of the commissioners of His Majesty's woods, forests, and land revenues,** R. S. SANDERS and G. C. L. GOWER ([*Gt. Brit.*] *Commrs. Woods, Forests, and Land Rev. Rpt.*, 101 (1923), pp. 43).—This is the customary report (E. S. R., 48, p. 841), and consists as usual for the most part of tabulated data concerning revenues, expenditures, leases, sales of lumber, etc.



**Administration report of the forest department of the Madras Presidency for the year ending March 31, 1922**, D. T. BARRY ET AL. (*Madras Forest Dept., Ann. Admin. Rpt., 1922, pp. 89+XLIV+10*).—In this, as in the preceding report (E. S. R., 47, p. 748), there are included the statements of the chief conservator and of the administrative officers for the six forest circles and for the Madras Forest College at Coimbatore. Appended are the usual statistical tables relating to revenues, expenditures, alterations in area, grazing, yield of lumber and various forest products, etc.

**Forestry commission report for the year ended June 30, 1923**, R. DALRYMPLE-HAY, N. W. JOLLY, and W. E. WEARNE (*N. S. Wales Forestry Comm. Rpt., 1923, pp. 14*).—This is the usual annual report (E. S. R., 49, p. 342).

**Annual progress report upon State forest administration in South Australia for the year 1922-23**, W. GILL (*So. Aust. State Forest Admin. Ann. Rpt., 1922-23, pp. 12, pls. 8*).—This is the customary report (E. S. R., 48, p. 740) of the Woods and Forests Department.

**[Annual reports of the New Zealand State Forest Service, 1922 and 1923]**, L. M. ELLIS ET AL. (*New Zeal. State Forest Serv. Rpt. 1922, pp. 25, figs. 10; Ann. Rpt. Dir. Forestry, 1923, pp. 30, figs. 11*).—These reports for the years ended March 31, 1922 and 1923, contain information concerning the activities of the recently organized forest service (E. S. R., 47, p. 41).

**Forests and forestry in New Zealand** (Wellington: *State Forest Serv., 1923, pp. 36, figs. 17*).—This is the official statement concerning forest resources and forestry activities prepared for the Imperial Forestry Conference held at Ottawa in 1923. Under the heading of research, it is stated that studies in the regeneration of commercially valuable native species indicate that, under conditions of partial shade and exclusion of fire and grazing animals, reproduction is certain. Other studies indicate that the mixed southern beech and taxad forests will give place after selective cuttings to pure beech stands, and that beech forests are gradually extending their range to tussock grasslands. *Pinus radiata* is being spaced at 8 ft. in plantations, as a result of studies which show that as clean trunks can be produced at this distance as at 6 ft. A study of mixed plantings showed that pure stands are more satisfactory. The average annual increment of *P. radiata* from 9 to 17 years of age was 398.6 cu. ft.

**Pulpwood and wood pulp in North America**, R. S. KELLOGG (*New York and London: McGraw-Hill Book Co., Inc., 1923, pp. XII+273, figs. 88*).—A comprehensive treatise presenting statistical information concerning production and consumption, processes of manufacture, logging and milling operations, species utilized and their special properties, present supply of pulpwood timber, and need of a constructive policy of production and afforestation.

## DISEASES OF PLANTS.

**Plant pests and parasites, preventives and remedies**, H. J. WRIGHT (*London: Country Life; New York: Charles Scribner's Sons, 1922, pp. 32, fig. 1*).—This booklet deals with pests and parasites affecting flowers, fruits, and vegetables from the directly practical point of view, outlining protective applications.

**Formation of perithecia by *Aspergillus oryzae***, H. ZIKES (*Centbl. Bakt. [etc.], 2. Abt., 56 (1922), No. 14-16, pp. 339-343, figs. 3*).—The details and results are indicated of culturing, for from 8 to 21 days, *A. oryzae*.

**The distribution of *Claviceps***, R. STÄGER (*Centbl. Bakt. [etc.], 2. Abt., 56 (1922), No. 14-16, pp. 329-339, figs. 2*).—A study is detailed of the biology of the

distribution of sclerotia of *Claviceps* spp., indicating unsolved aspects of the problem.

**Treatment of seed to control root and stalk rots**, B. B. BRANSTETTER (*Abstr. in Phytopathology*, 12 (1922), No. 1, p. 30).—Experiments carried on at the Missouri Experiment Station are said to have shown the practicability of disinfecting seed by treating it momentarily in alcohol and then in corrosive sublimate solution, 1:1,000, for one hour.

**Fungus diseases and other seasonal conditions for 1921**, T. F. MANNS (*Peninsula Hort. Soc. [Del.] Trans.*, 35 (1922), pp. 140–144).—Potatoes showed about 5 per cent late blight in Delaware during 1919 and fully 20 per cent in 1920, but in 1921, owing to dry weather and high temperatures, neither foliage injury nor tuber rot appeared. Wheat leaf rust lowered production from 30 to 40 per cent in 1919, infected heavily seedling wheat during the mild autumn weather of 1920, and reduced yield fully 20 per cent in 1921. The corn earworm is charged with loss due to its introducing *Fusarium moniliforme* and *Cephalosporium sacchari* into the ear. Internal infection of corn produced injury proportional to the amount of such infection. Several apple varieties were strongly marked by bitter pit as a result of drought. Drought and the generally weakened condition of the trees from frost permitted heavier copper injury than usual.

Other crop diseases, as briefly indicated, were not quite so severe as usual during this season.

**[Report of the New York State Station] division of botany** (*New York State Sta. Rpt. 1923*, pp. 31, 32, 33–35).—Previous experiments having indicated the superiority of liquid Bordeaux mixture over dust for the control of potato diseases, the work was repeated in 1923, the dust being applied every week at a greater concentration of copper than previously and compared with Bordeaux mixture applied every two weeks. Owing to extremely dry weather, insect and fungus attacks were not severe, and neither treatment gave much indication of increased yields. Roguing for the control of leaf roll and mosaic of potatoes was carried on for several years and has given only partial success in eradicating these diseases.

Observations and experiments showed that late-planted beans were less liable to bacterial blight than early plantings, and at the station plantings made about June 15 gave the best results. Uneven ripening of red kidney beans is attributed to hard seed coats, and such beans can be eliminated by soaking the seed for 24 hours before planting, rejecting those that do not swell.

Investigations of black rot of cauliflower in Long Island showed that the disease is carried over winter on old cabbage and Brussels sprouts plants, and not on cauliflower. Screening cauliflower plants with cheesecloth protected them from attack of black rot. Spraying with Bordeaux mixture is said to have severely injured the plants. A brief description is given of an obscure disease of cauliflower characterized by thick, narrow leaves, the plants producing no heads. Certain lots of seed are said to have shown a tendency to produce plants affected by this trouble, and that its occurrence was also influenced by soil conditions and the fertilizers used.

Experiments for the control of carrot blight, due to *Macrosporium carotae*, by spraying with Bordeaux mixture showed that the foliage was not injured by the 5-5-50 mixture and that the mixture was less readily washed off by rain than was copper lime dust.

In experiments for the control of mildew of Lima beans, it was learned that the Lima bean plant is quite susceptible to injury by spray mixtures containing copper.



An account is given of raspberry disease investigations, most of the work having been previously noted (E. S. R., 49, p. 546). In continuation of previous work the results of roguing plants for the elimination of mosaic are said to show that the average amount of mosaic in 13 varieties was 1.5 per cent where stock was obtained from plantings rogued for the first time in 1922. In connection with the roguing, an investigation was conducted on the possibility of the spread of mosaic to the border plants, and stock which was dug in 1922 from the borders of the areas where mosaic prevailed produced plants that were infected from 8 to 24 per cent.

**Report of the acting plant pathologist, C. M. TUCKER** (*Porto Rico Sta. Rpt. 1922, pp. 16-18, pl. 1, figs. 1*).—According to the author, rice harvested from test plats at the station during 1922 showed, in many instances, small brown spots on the glumes of the grain. A study was made of these spots, and it was found that the disease was due to a species of *Helminthosporium*. Preliminary experiments for the control of the disease indicated that chemical disinfectants were of little value. The most practical means of control is believed to be the selection of clean seed.

A brief account is given of a disease affecting grapefruit trees in which the affected trees assume a chlorotic appearance, the leaves turn yellow, and the young growth shows more or less frenching. The disease apparently spreads very slowly, and while the roots of the trees showed the presence of a *Fusarium* it is deemed doubtful if the organism is responsible for the trouble. It is believed more probable that it is due to some soil condition.

**Report of the mycologist, [W. F. BEWLEY]** (*Expt. and Research Sta., Cheshunt, Herts., Ann. Rpt., 7 (1921), pp. 32-41*).—The main problem studied during the year reported on was a cucumber leaf spot, but tomato seedling foot rot and damping-off, and a new tomato root rot also received attention. Other diseases noted (some hitherto unreported) include tomato mosaic, root rot (*Sclerotium* sp.), and fruit rot (*Botrytis* sp.); cucumber leaf spot (*Cladosporium* sp.) and mosaic; Arum soft rot (*Bacillus aroideae*); carnation rust (*Uromyces caryophyllinus*); sweet pea and Antirrhinum wilt (*Verticillium albo-atrum*); and broad bean, culinary pea, and clover streak (*B. lathyri*).

**Mycological report** (*Expt. and Research Sta., Cheshunt, Herts., Ann. Rpt., 8 (1922), pp. 34-45*).—During the year 1922 the mosaic diseases of tomatoes and cucumbers constituted the main object of research, but the new tomato root rot referred to in the previous report (see above) and stem rot of tomato also received attention.

The tomato root rot is discussed as regards symptoms, inoculation experiments, the causal organism (*Sclerotium setosum*), and control measures. The disease appears to be introduced in straw manure.

Tomato *Botrytis* stem-rot infection occurs through leaf bases, attacking cortex, vascular tissues, and pith, producing a brown discoloration. Under suitable conditions the fungus spreads rapidly through the stem, severing all connection between the healthy parts of the plant above and below the affected area, thus killing all parts above the lesion. Leaves and fruits are also attacked, becoming a dangerous source of infection to the stems. Control measures are concerned with a careful regulation of the ventilation, circulation, and humidity of the air and correct methods of defoliation and pruning.

Tomato mosaic is readily carried on the hands of workers, also by aphids and by the white fly. Carrier plants may also exist. High temperatures and rapid growth accelerate the progress of the disease. Mosaic disease of tomato may be readily transmitted to the petunia, tobacco, bittersweet, and black nightshade, and less readily to the potato. It is also possible to cross inocu-

late between these. Mosaic disease of cucumber has not been transmitted experimentally to any of these plants.

**Diseases and pests of cultivated plants in the Dutch East Indies in 1921,** C. J. J. VAN HALL (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 53 (1922), pp. 46*).—This report follows the general trend of those previously noted (E. S. R., 38, p. 548; 44, p. 351; 46, p. 343; 49, p. 144.)

**Diplodia zeae as an ear and root parasite of corn,** E. E. CLAYTON (*Abs. in Phytopathology, 12 (1922), No. 1, p. 29*).—The prevalence of *D. zeae* in seed corn is pointed out. When infected seed was planted root rot developed severely at soil temperatures of from 21 to 24° C. (69.8 to 75.2 F.). At higher temperatures the organism was less active, and plants were not affected at from 15 to 18°. Inoculation experiments with the fungus isolated from rotting roots infected ears of corn. Natural infection of the ears was observed at various dates.

**Diplodia of corn in Iowa,** L. W. DURRELL (*Abs. in Phytopathology, 12 (1922), No. 1, pp. 29*).—Studies by the author are said to indicate that a high humidity is necessary for the optimum growth of this fungus. The temperature relations were determined, and the optimum growth was said to occur from 29 to 31° C. (85.2 to 88.8° F.). No growth was observed above 36° or below 10°. The infection of corn by the fungus is said to take place largely through the nodes. The shanks of the ears are frequently infected, and cultural studies indicated that the shanks become infected from the node. No constant relation was found between *Diplodia* infection and the broken shanks and stalks.

**The relation of soil temperature to the development of the seedling blight of corn caused by Helminthosporium sp.,** W. G. STOVER (*Abs. in Phytopathology, 12 (1922), No. 1, pp. 30*).—Experiments are said to have shown that the optimum soil temperature for the growth of corn roots was apparently between 20 and 24° C. (68 to 75.2° F.) and for the growth of the tops from 24 to 28°. Inoculation experiments indicated that blight developed to some extent at all temperatures tested but was more marked between 16 and 24°. At 20° practically 100 per cent of the plants were infected.

**Incidence of fungus diseases on oat varieties in the seasons, 1921–22,** K. SAMPSON and D. W. DAVIES (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. C, No. 3 (1921–22), pp. 55–59*).—Since the season of 1920, which was remarkable for a severe outbreak of crown rust, oats have sustained comparatively slight injury from fungus attacks. The greatest damage, probably, was due to loose smut in 1921 and to halo blight (on Odal) in 1922. These notes summarize the records made at the station during the two seasons, and indicate the extent to which different oat varieties have been attacked by fungus diseases, including crown rust (*Puccinia lolii*), black rust (*P. graminis*), mildew (*Erysiphe graminis*), loose smut (*Ustilago avenae*), covered smut (*U. levis*), stripe (*Helminthosporium avenae*), and halo blight.

**Infection capabilities of crown rust of oats,** G. R. HOERNER (*Phytopathology, 12 (1922), No. 1, pp. 4–15*).—The results are given of inoculation experiments with urediniospores of *Puccinia coronata* from several localities on about 80 species and varieties of grasses and cereals and with urediniospores of *P. coronata* and *P. graminis avenae* on about 40 grass hosts. It is claimed that there were slight differences in infection capabilities between the four specimens of *P. coronata* used in the experiments. There were a number of common hosts found for *P. coronata* and *P. graminis avenae*. The experiments are considered to show a host range for these rusts that is much more extensive than was formerly believed to be the case.



**Experiments in the control of oat smut**, B. T. DICKSON, R. SUMMERBY, and J. G. COULSON (*Quebec Soc. Protect. Plants, Ann. Rpt., 15 (1922-23), pp. 102-105*).—In cooperative small scale seed disinfection tests briefly noted, it was found that the germination of hull-less oats was materially reduced by formaldehyde treatments, though copper carbonate and copper sulphate-lime treatments appeared to stimulate germination. In the control of smut both copper sulphate-lime dust and copper carbonate dust were as effective as the formaldehyde spray within the limits of the experiment.

**The effect of fertilizers on the development of stem rust of wheat**, E. C. STAKMAN and O. S. AAMODT (*Abs. in Phytopathology, 12 (1922), No. 1, p. 31*).—Experiments conducted at the Minnesota Experiment Station are said to have shown that the amount of rust was not changed directly by any fertilizer or combination of fertilizers, although date of maturity, degree of lodging, crinkling, shriveling of seed, percentage of yellow berry, and yield were affected profoundly. Leaf rust developed most abundantly on plats fertilized with nitrogen. Neither potassium nor acid phosphate counteracted the effect of nitrogen in lower yield on some types of soil.

**The Ophiobolus causing take-all of wheat**, H. M. FITZPATRICK, H. E. THOMAS, and R. S. KIRBY (*Mycologia, 14 (1922), No. 1, pp. 30-37, pl. 1, fig. 1, Abs. in Phytopathology, 12 (1922), No. 1, p. 27*).—In a previous publication (E. S. R., 44, p. 343) the occurrence of take-all due to a species of *Ophiobolus* was reported in Monroe County, N. Y. A comparison of the fungus with that occurring in Europe and Australia showed that the species were identical, and studies of the type indicate that the organism should be known as *O. cariceti*.

**The take-all disease of cereals and grasses**, R. S. KIRBY (*Abs. in Phytopathology, 12 (1922), No. 1, pp. 27*).—The author claims that *Ophiobolus cariceti* has been demonstrated to be the cause of the take-all disease previously reported as occurring in New York on wheat, rye, and *Agropyron repens*. Inoculation experiments have shown that the fungus produces typical perithecia on wheat, barley, and rye, and on one or more species of *Agropyron*, *Bromus*, *Elymus*, *Festuca*, *Hordeum*, *Hystrix*, *Lolium*, and *Phalaris*.

**Some recent investigations on the control of *Sclerotinia libertiana* in the greenhouse on the muck farms of Bergen County, N. J.**, R. F. POOLE (*Phytopathology, 12 (1922), No. 1, pp. 16-20, figs. 3*).—Considerable losses are reported by the damping-off of young celery plants in greenhouses in New Jersey. An investigation showed the fungus (*S. libertiana*) was carried into the greenhouses in soil from fields where lettuce had been grown in rotation with celery.

The author claims the disease can be controlled in the greenhouse by the use of virgin soil in the beds and by treating infected soils with formaldehyde.

**The control of angular leaf spot of cotton**, C. A. LUDWIG (*Phytopathology, 12 (1922), No. 1, pp. 20-22*).—A report is given of a test of the treatment of cotton seed with sulphuric acid and corrosive sublimate recommended by the South Carolina Experiment Station for the control of the angular leaf spot of cotton due to *Bacterium malvacearum* (E. S. R., 41, p. 50). The results of the author's investigations are said to confirm previous reports that the treatment gives perfect control.

**Banana wilt and the manila hemp plant**, H. A. LEE and F. B. SERRANO (*Philippine Agr. Rev., 16 (1923), No. 2, pp. 104-107*).—The object of this article is to describe a disease of the manila hemp plant, commonly known as banana wilt, which is said to have been described by Reinking (E. S. R., 41, p. 841) as abaca (manila hemp) heart rot and ascribed to bacteria undetermined as to identity. Later increase in seriousness led to investigations, the first steps in

which showed the disease to be destructive as yet only in the Provinces of Laguna and Cavite.

Isolation and inoculation studies were carried out, and a *Fusarium* appeared to be pathogenic in this connection, apparently indistinguishable from *F. cubense*. This fungus, however, produces a set of symptoms on the manila hemp plant different from that on the banana plant, so far as yet tested. The organism can exist in the soil and can infect from that source.

**A bacterial stripe disease of proso millet**, C. ELLIOTT (*Jour. Agr. Research* [U. S.], 26 (1923), No. 4, pp. 151-160, pls. 4).—A description is given of a disease of proso millet first recognized at the South Dakota Experiment Station in 1917. Later the author found the disease at Madison, Wis., and carried on an investigation as to its cause. It was found that the stripe disease was due to the organism *Bacterium panici*, which is described as a new species. It is believed that the disease is probably transmitted by the seed, but no methods of control have been worked out.

**Diseases of Irish potatoes**, T. C. JOHNSON (*Peninsula Hort. Soc. [Del.] Trans.*, 35 (1922), pp. 147-152).—It is stated that in the territory covered by the membership of this society the average potato yield is only two-thirds or three-fourths of what it might be, owing largely to potato diseases. Regarding a few of these discussion is here given, including scab, blackleg, mosaic, *Rhizoctonia* disease, and *Fusarium* wilt. Since some of the diseases are carried by insects, combination sprays are suggested.

**Potato diseases prevalent in Kansas and their control**, L. E. MELCHERS (*Kans. State Hort. Soc. Bien. Rpt.*, 36 (1920-21), pp. 124, 125).—Earlier experimentation having shown that dipping uncut seed potatoes in barrels containing formaldehyde would control scab but not the new diseases (causing the principal damage), corrosive sublimate was tried out (as a war measure) and was found to be adapted to control some others of the seed-borne diseases (as blackleg and scurf) and to increase yields. Bordeaux mixture will eliminate early blight, and is under trial each year for tipburn.

**Collected leaflets on cultivation and diseases of potatoes** (*London: Min. Agr. and Fisheries*, 1921, pp. 11+69, pls. 15, figs. 8).—Following up No. 1, *Fungus Pests of Fruit Trees*, and No. 2, *Insect Pests of Fruit Trees*, this third volume embodies Leaflets Nos. 23, 105, 117, 127, 137, 164, 173, 193, 232, 296, 362, and 373, concerned chiefly with potato growing, handling, and diseases, besides briefer discussion of other diseases or disordered conditions.

**Potato diseases**, E. M. DOIDGE (*Johannesburg: Specialty Press of S. A., Ltd.*, [1920], pp. 49, figs. 25).—A general account in some detail is given of potato diseases in South Africa, including early blight or leaf curl (*Macrosporium solani*); scab (*Actinomyces chromogenus*); corky or powdery scab (*Spongospora subterranea*); black scab, canker, or wart disease (*Synchytrium endobioticum*); bacterial wilt (*Bacterium solanacearum*); *Rhizoctonia* disease (*Cor-ticium vagum solani*); late blight (*Phytophthora infestans*); and internal brown fleck.

**Potato black wart**, E. FOËX (*Rev. Hort. [Paris]*, 95 (1923), No. 20, pp. 442, 443, pl. 1).—Potato black wart (*Synchytrium endobioticum*), occurring mainly in northern Europe (but also in America), is discussed as to the biology of the organism and practical phases related to its dissemination and control.

**Rice investigations**, L. G. WILLIS and J. O. CARRERO (*Porto Rico Sta. Rpt.* 1922, pp. 3, 4).—Previous investigations (E. S. R., 31, p. 816) are said to have shown that chlorosis of rice, due to a lack of iron, is associated with an excess of calcium carbonate in the soil. The authors report additional investigations which seem to indicate that a similar effect is produced by some of the fertilizing materials used in growing the crop. Wherever fertilizer



compounds tend to precipitate iron the plants usually develop chlorosis, while fertilizers having nonassimilable acidic residues were effective in preventing chlorosis on a moderately alkaline soil. Other experiments are said to show that in all probability ammonium sulphate can be satisfactorily used for rice, pineapples, corn, sugar cane, and citrus fruits, as its physiological reaction tends to prevent chlorosis.

The authors claim that in their experiments with rice grown on a compact soil excessive applications of nitrogenous fertilizers caused a sterility which appeared to be the same as the so-called straight-head disease. A form of sterility of rice due to an excessive accumulation of nitrogen in plant tissues is also described.

**Soil not the source of cane mosaic**, R. M. RAMOS (*Rev. Agr. Puerto Rico*, 11 (1923), No. 3, pp. 13-19).—Mosaic or yellow stripe of sugar cane has become, since its appearance in 1915, the most important economic and scientific phytopathological problem in Porto Rico. The disease does not originate in the soil, nor is it due to soil conditions. Clean stock and varietal resistance are chiefly relied upon to control the trouble.

**Mosaic disease in Jamaica** (*West India Com. Circ.*, 38 (1923), No. 653, pp. 435, 436).—C. G. Hansford, microbiologist, is credited with information gained as the result of a tour of inspection of the central and western portions of Jamaica during the summer of 1923.

Measures are recommended for the eradication of cane mosaic. These include roguing every week for three or four months in cases where infection is less than 10 per cent. Subsequent (secondary) outbreaks involving a few canes to a root may, in case of dry areas, be remedied by removing, during the life of the plant, the diseased canes as they appear. Infections exceeding 10 per cent should be remedied by replanting. The utilization of Uba cane for planting is also recommended.

**Diseases of the sweet potato**, T. F. MANNS (*Peninsula Hort. Soc. [Del.] Trans.*, 35 (1922), pp. 132-136).—In this paper the author summarizes 10 years of study and the results on sweet potato diseases and their control in field and storage on the peninsula.

**Storage and marketing of sweet potatoes [with reference to diseases]**, J. R. ESKRIDGE (*Peninsula Hort. Soc. [Del.] Trans.*, 35 (1922), pp. 136-139).—The plan and arrangement are described of a storage house at Seaford as designed to provide all possible conditions for the successful keeping of sweet potatoes, with an account of information gained as to advantageous storing and marketing practice.

**A new fruit rot of tomatoes**, R. F. POOLE (*Bot. Gaz.*, 74 (1922), No. 2, pp. 210-214, pl. 1).—During the summer of 1921 a fungus growth following cracking of the fruit was noted on tomatoes in several localities of Burlington and other counties in New Jersey. The cracking was attributed to one or more physiological causes. An examination showed a very dense fluffy growth of *Oidium* (*Oospora*) *lactis* in the open cracks of ripe fruit on and near the ground. This fungus, under field conditions, penetrated the interior of the tomato, reducing the fruit to a soft rotten mass in from two to five days. The disease was common in the fields observed. No infection was noted on uninjured ripe fruit, cracked green fruit, or other parts of the plant. Inoculations of ripe fruit were positive. Treatments with Bordeaux sprays and dusts gave but slight control of the disease.

**Tomato wilt experiments** (*Jour. Dept. Agr. Victoria*, 20 (1922), No. 1, pp. 34-36).—A summary of experiments for the prevention of tomato spotted wilt gives little information, owing to the practical nonappearance of the disease.

**Apple scab and its control**, E. C. AUCHTER (*Peninsula Hort. Soc. [Del.] Trans.*, 35 (1922), pp. 107-112).—Apple scab, noted first in Europe during 1819, reported from France in 1829, and recorded as in Pennsylvania and New York during 1834, has in recent years become an important factor in apple culture even in the Rocky Mountain and Pacific Coast apple sections. Now generally distributed over the country and inflicting injury upon apple interests in many sections, it has recently begun to cause serious loss in parts of Delaware, Maryland, Virginia, and West Virginia. Information is furnished regarding the disease, degrees of susceptibility, and control measures, including a spray calendar for apples.

**Apple scald and its control**, C. BROOKS, J. S. COOLEY, and D. F. FISHER (*U. S. Dept. Agr., Farmers' Bul.* 1380 (1923), pp. 2+17, figs. 12).—A popular account is given of apple scald, a disease of storage and market apples, and suggestions are given for its control. Wrapping the fruit in oiled wrappers is said to have given the most complete control, and aeration, particularly during delayed storage, is considered important.

**Brown rot of stone fruits**, W. LAIDLAW and C. C. BRITTLERBANK (*Jour. Dept. Agr. Victoria*, 20 (1922), No. 7, pp. 442, 443).—The season of 1920-21 in the orchards at Bairnsdale was a disastrous one, over 75 per cent of the peaches being destroyed by brown rot. The first work undertaken was to remove all diseased materials, the second to spray July 28 when the trees were dormant, a second time with the same preparations when the buds showed pink, and a third time three or four weeks before picking time.

The best results were obtained with commercial lime sulphur (1 in 9, 1 in 20, 1 in 30, and 1 in 40 for an extra spray in some cases), no brown rot, leaf injury, or aphids being present. Bordeaux and Burgundy with the different third and fourth sprays gave very good results, so far as brown rot was concerned, copper sulphate and copper acetate being the least effective.

**Spraying experiments for brown rot of stone fruit (*Sclerotinia fructigena*)**, A. A. HAMMOND (*Jour. Dept. Agr. Victoria*, 20 (1922), No. 3, pp. 182-189).—Work done against *S. fructigena* on stone fruits indicates that the brown rot fungus will be difficult to control during a wet season, though its eradication is possible during a season unfavorable to its development.

Treatment (to extend over at least three seasons) advised as the result of the season's work includes destruction of all mummied fruits and infected wood; early plowing under of all diseased material; spraying cherries with 12-8-90 Bordeaux, preferably when 10 per cent of the blooms have expanded, but earlier or later according to weather; spraying again with 4-4-40 Bordeaux when the fruit has set, and again with Woburn Bordeaux 14 days before ripening; treating plums the same as cherries; spraying peaches at the pink stage with full-strength lime sulphur or Bordeaux; and spraying again with self-boiled lime sulphur immediately after the fall of the flowers, and again with sulphur spray 30 days before gathering the fruit. As to cost, the homemade sulphur washes were the cheapest and the copper acetate the most expensive.

**Citrus scab**, W. V. TOWER (*Porto Rico Sta. Rpt.* 1922, pp. 13, 14, pls. 2).—An account is given of the successful use of Bordeaux mixture to which 0.5 per cent of oil was added for the control of citrus scab. Several thousand grapefruit trees were sprayed, and the resulting crop was practically free from scab, while the check trees produced 50 per cent or more of fruit that was badly scabbed.

**[Palm bud rot in southern India]**, W. McRAE (*India Dept. Agr. Mem., Bot. Ser.*, 12 (1923), No. 2, pp. 15-70, pls. 2, fig. 1).—This account is in two main sections, the first dealing historically with operations against bud rot of palms in south India, the second with inoculation experiments employing *Phy-*



*tophthora palmivora* on *Borassus flabellifer* and *Cocos nucifera*. Subdivisions present in some detail accounts of the operations against the trouble in the districts of Godavari, Kistna, and Malabar; a general review of the operations and their results; the occurrence of palmyra bud rot in other parts of India; the occurrence of bud rot of the coconut palm; the spread of bud rot; and inoculation experiments with *P. palmivora* from the palm and from pure cultures.

The disease travels persistently, even though (in the main) slowly, through tapping operations, rhinoceros beetle activity, rain splashing on the expanded infected leaves, and (occasionally long distances) through transport by man.

It has been shown by others named that *P. palmivora* will infect living leaves of the palmyra palm, also that it will infect living leaves of the coconut and will kill seedlings.

The present experiments confirm and amplify the work above mentioned, and show definitely that *P. palmivora* kills both the palmyra and the coconut palm, that it can pass from one tree to the other, and that all the symptoms of bud rot have been reproduced in both palms as a result of infection by this fungus. When the organism penetrates the soft tissue of the stem below the growing point the tissue is killed and a rot ensues. Other organisms then begin to work and carry on the rot at a greater rate until the whole central part of the crown is involved. That the fungus is the primary cause of the rot and the controlling factor in the epidemic form in south India is all that is here claimed. From the economic point of view these other organisms are of secondary importance, and they have not been worked out. These results are said to meet completely the criticism of Sharples and Lambourne (E. S. R., 48, p. 849) regarding the cause of bud rot of palms in India.

**Report on resistant plants for root-knot nematode control**, J. A. MCCLINTOCK (*Georgia Sta. Circ.* 77 (1922), pp. 4).—A brief report is given of tests made to determine what plants would be suitable to be grown in rotations for the control of nematodes. Of the vegetables tested, onions proved to be the only ones resistant. Several varieties of cowpeas, soy beans, all varieties of velvet beans, and peanuts were found to be resistant, and grasses and cereals showed slight infestation only.

Attention is called to seedling peaches that are resistant, and to the fact that Marianna plums may be used as stocks since they are not subject to infestation.

## ECONOMIC ZOOLOGY—ENTOMOLOGY.

**On the numbers and local distribution of Illinois land birds of the open country in winter, spring, and fall**, S. A. FORBES and A. O. GROSS (*Ill. Nat. Hist. Survey Bul.*, 14 (1923), Art. 10, pp. 397-453).—This is a detailed report of investigations, conducted in continuation of those previously noted (E. S. R., 49, p. 151).

**Some Ohio birds: Their food habits and value**, H. A. GOSSARD (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 11-12, pp. 180-186, figs. 3).—This is a brief popular account, in which the food habits of a few of the more important bird friends of the farmer are considered with means for their protection.

**A valuable snail poison**, A. J. BASINGER (*Jour. Econ. Ent.*, 16 (1923), No. 5, pp. 456-458).—Work by the California State Department of Agriculture at La Jolla has shown that a poison bait made of 1 part calcium arsenate and 16 parts bran will eradicate *Helix pisana*. It is also said to be giving excellent results in the control of *H. aspersa*.

**Animal parasitology**, D. CARAZZI (*Parassitologia Animale*. Milan: Soc. Editrice Libr., 1922, 2. ed., rev. and enl., pp. [XI]+467, pls. 4, figs. 236).—This

work on animal parasites and animal transmission of parasitic affections of man and the domestic animals, the first edition of which was issued in 1913, treats of the subject in three parts. Part 1 is devoted to the Protozoa (pp. 9-204), part 2 to Vermes (pp. 205-327), and part 3 to Arthropoda (pp. 329-450).

**Report of standing committee on arsenic**, B. R. COAD ET AL. (*Cong. Rec.*, 65 (1923), No. 10, pp. 310-312).—This is a report of a standing committee of producers and manufacturers on the available supply and prospective supply of calcium arsenate, submitted by the Secretary of Agriculture. The report, which consists of a résumé of the situation, was drawn up at a meeting of the committee held in New York on December 6, 1923. An earlier report has been noted (*E. S. R.*, 48, p. 749).

**The constitution of oil emulsions**, E. L. GRIFFIN (*Jour. Econ. Ent.*, 16 (1923), No. 5, pp. 430-432).—This is a contribution from the insecticide and fungicide laboratory of the U. S. D. A. Bureau of Chemistry.

"In an emulsion of mineral oil with soap and water, the mineral oil is divided into very small droplets which are suspended in the watery medium. The soap is added to keep these droplets from coalescing and finally separating out. Its action is as follows: Part of it is broken down, the fatty acids being dissolved in the kerosene and the alkali remaining in the water; part of it forms a film between the oil and the water, preventing the droplets from coalescing, thus stabilizing the emulsion; and any excess soap remains in water solution and helps the spreading qualities of the spray. The breaking down of the soap may be prevented, or at least made negligible, by the addition of excess alkali, thus preventing an apparent waste of soap. Two emulsions of the type used in practice were analyzed and the distribution of the soap in them reported."

**On the entomological publications of the United States Government**, J. S. WADE (*Ent. Soc. Wash. Proc.*, 25 (1923), No. 1, pp. 32).—This is a comprehensive account of the entomological publications published by the United States Government. In addition to the discussion, the paper includes a list of the more important bibliographical aids for research work among public documents, of the principal series of publications issued by the U. S. Department of Agriculture prior to July 1, 1913, the new series and the technical series of bulletins issued from the U. S. D. A. Bureau of Entomology, the numbers of publications of the Federal Horticultural Board, the *Journal of Agricultural Research*, of Farmers' Bulletins, U. S. D. A. biographical works, circulars, etc., the publications of the U. S. National Museum, etc.

**Insects and other arthropods, except Coleoptera and Lepidoptera**, R. von HANSTEIN (*Die Insekten sowie die Übrigen Gliederfüßer mit Ausnahme der Käfer und Schmetterlinge*. Wiesbaden: Pestalozzi Verlags-Anstalt, 1923, pp. VIII+188, pls. 20, figs. 90).—This is a popular account, which includes 20 colored plates of insects.

**Contribution to the knowledge of noxious insects**, F. SILVESTRI (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Super. Agr. Portici*, 16 (1922), pp. 221-301, pls. 2, figs. 50).—This contribution consists of descriptions and a brief summary of the status of knowledge of insect pests and particularly of parasites of several important pests, namely, *Gypsonoma neglectana* Dup., *Epiblema penkleriana* F. R., the eye-spotted bud-moth, and *Recurvaria nanella* Hübner.

**Predacious forms of beneficial insects**, C. R. CUTRIGHT (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 11-12, pp. 173-179, figs. 8).—This is a popular summary of information in which the subject is discussed under the headings of dragon flies, assassin and soldier bugs, lace-wing flies, tiger and ground beetles, lightning bugs, ladybird beetles, syrphid flies, and wasps.



**Citrus pests in Brazil**, G. BONDAR (*Bol. Agr., Com. e Indus. [Bahia]*, No. 1-6 (1922), pp. 5-53, pls. 3, figs. 22).—This is a summary of information on the more important insect enemies of the orange and other Aurantiaceae in Brazil.

**The important forest insects**, J. WILL, rev. by M. WOLFF and A. KRAUSSE (*Die Wichtigsten Forstinsekten*. Neudamm: J. Neumann, 1922, 2. ed., rev. and enl., pp. XVI+209, figs. 203).—This is a brief account of the more important insect enemies of German forests.

**The protection of aircraft from the attacks of insects** (In *Supplement to Handbook of German East Africa*. London: Admiralty and War Office, 1923, pp. 48-58, pl. 1).—This is a brief discussion of the means of protecting finished airplanes and stores of spare parts from wood-boring beetles and termites.

**[Report of the New York State Station] division of entomology** (*New York State Sta. Rpt.* 1923, pp. 39-43).—A brief statement is made of the more important work of the year on major entomological projects. These include studies of apple and pear insects, control of insects by dusting, studies on paradichlorobenzene for peach borer, sulphid sprays for control of San José scale, control of cabbage maggot in cabbage seed beds, the currant aphid, raspberry insects, ecological investigation of grape insects, and studies on cucumber beetles, on cabbage insects, and on potato insects. A bulletin reporting upon a series of experiments to determine the range of usefulness of tobacco dust as an insecticide with special reference to its toxicity to *Myzus persicae* has been noted (E. S. R., 49, p. 552).

**Report of the entomologist [of the Virgin Islands]**, C. E. WILSON (*Virgin Islands Sta. Rpt.* 1922, pp. 15-18).—This is a report of the work of 1922 up to August 31, when the resignation of the entomologist became effective. The report deals with scale insects, sugar cane insects, and tobacco insects, and includes a discussion of trap pans as a control for truck crop insects.

The author adds two species of scale insects, namely, *Hemichionaspis minor strachani* and *Pseudaonidia tesserata* to the list presented in the preceding report (E. S. R., 48, p. 354). *H. minor strachani* did considerable damage to the kenepny tree (*Melicocca bijuga*), and both species are said to have severely injured grapevines in 1920. The insects mentioned as injuring sugar cane include the rhinoceros beetle (*Strategus titanus*), the West Indian sugar cane borer (*Diaprepes abbreviatus*), the fall army worm, and the sugar cane borers *Lagochirus araneiformis* and the sericeous palm weevil. While tobacco is not now a commercial product in the islands, a brief account is given of insects attacking the crop and which will be of importance should the crop be grown on a commercial scale. The species mentioned are the tobacco worm moth (*Protoparce scria*) and tomato worm (*P. rustica*), the tobacco flea-beetle, tobacco suck-fly (*Dicyphus* sp.), tobacco budworm (*Heliothis virescens*) and bollworm, snowy tree cricket (*Oceanthus niveus*), West Indian sugar cane root borer (*Diaprepes abbreviatus*), and the cigarette beetle. The work with trap pans led to the conclusion that molasses does not attract small moths and that truck crop insects are not to be controlled by means of trap pans. Bulletins relating to insects commonly found attacking cotton (E. S. R., 49, p. 352) and those attacking truck crops (E. S. R., 49, p. 654) have been noted.

**Annual report of the Government entomologist [of Uganda], 1921**, H. HARGREAVES (*Uganda Dept. Agr. Ann. Rpt.*, 1921, pp. 57-64).—This report on the occurrence of important insects of the year and work therewith is presented under the headings of the various crops attacked.

**Thrips injury to citrus fruits**, C. P. LOUNSBURY (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 3, pp. 243-249).—The author discusses the injury to

citrus in South Africa by a very small undetermined species of thrips that is widely prevalent. While the species concerned is distinct from that occurring in California, the remedial measures effective in California, which are considered at some length, are thought to be applicable in South Africa.

**Some insect pests of the coconut palm**, J. C. HUTSON (*Ceylon Dept. Agr. Yearbook*, 1923, pp. 37-43, pls. 3).—This summary of information, based upon observations during the past two years, supplements that noted in an earlier report (E. S. R., 50, p. 455).

**Kernel spot of pecan caused by the southern green soldier bug**, W. F. TURNER (*Jour. Econ. Ent.*, 16 (1923), No. 5, pp. 440-445, pl. 1).—Studies by the Georgia State Board of Entomology have shown the kernel spot to be a physiological trouble, resulting from the feeding of Hemiptera, particularly *Nezara viridula* L. Such feeding causes the tissue of the kernel to break down for a short distance around the puncture, resulting in a hemispherical discolored portion which becomes bitter and imparts its bitterness to the whole kernel. Only the kernel is affected, and the trouble can not be detected until the nut is cracked. The insects can cause kernel spot only during the period when the kernel is hardening. They do not breed on pecans; only the adults feed on the nuts. Cowpeas and soy beans are important breeding hosts and should not be used as cover crops in the orchards.

**Factors affecting the control of the tea mosquito bug (*Helopeltis theivora* Waterh.)**, E. A. ANDREWS (*London: Indian Tea Assoc.*, pp. [4]+260, pls. 46).—This is a detailed report of investigations conducted by the author, which deals with the various factors affecting the control of *H. theivora*, including spraying, climatic conditions, variety of plant, shade, cultivation, manuring, pruning, soil conditions, potash manures, chemical composition of the leaf of the plant, relation of the chemical composition of the leaf of the plant to that of the soil, etc. Diagrams and statistical data are appended.

**Life history of the tropical bedbug, *Cimex rotundatus*, in Panama**, L. H. DUNN (*Amer. Jour. Trop. Med.*, 4 (1924), No. 1, pp. 77-83).—This is a report of a series of studies of the life history, habits, etc., of *C. rotundatus* Sign. conducted by the author in Panama during the year 1921.

**The Douglas fir Chermes (*C. cooleyi*)**, R. N. CHRYSTAL ([*Gt. Brit.*] *Forestry Comn. Bul.* 4 (1922), pp. 50, pls. 9, figs. 12).—This is a report by the author in collaboration with F. Story of studies of the life history of *C. (Gillettea) cooleyi* Gill., which has made its appearance on Douglas fir in Great Britain. The bulletin includes a bibliography of 36 titles, keys to the genera and species of Chermesidae taken from the monograph of Börner (E. S. R., 21, p. 159), biological keys, etc.

**Aleyrodidae of Brazil**, G. BONDAR (*Aleyrodideos do Brasil. Bahia: Sec. Agr., Indus. e Obras Pub., Secç. Path. Veg.*, 1923, pp. III+183, figs. 84).—This is a descriptive catalogue of the Aleyrodidae of Brazil. Nine genera are erected and 55 species described as new.

**The white flies (Aleyrodidae) of Jamaica**, C. C. GOWDEY (*Jamaica Dept. Agr., Ent. Bul.* 3 (1923), pp. 6).—The author recognizes and describes seven species of Aleyrodidae as occurring in Jamaica.

**An aleurodid enemy of the pear and ash, *Trialeurodes inaequalis* n. sp.**, C. GAUTIER (*Ann. Soc. Ent. France*, 91 (1922), No. 4, pp. 337-350).—Under the name *T. inaequalis* the author describes and reports upon extended studies of an aleurodid which was found in large numbers in a botanical garden at Lyon on espalier pears and also at Châtillon d'Azergues, 20 km. from Lyon, on espalier pears and ash. A chalcidid parasite reared from a number of the aleurodid larvae differs slightly from *Prospaltella conjugata*, a parasite of *Aleurodes brassicae*.



**The effects of feeding punctures of aphids on certain plant tissues**, J. L. HORSFALL (*Pennsylvania Sta. Bul.* 182 (1923), pp. 3-22, figs. 13).—Following a brief introduction, the author reports upon methods and materials employed in this investigation. This is followed by accounts of piercing setae and their objective, the setal sheath, results of punctures upon the plant tissues, and the question of injected materials. The studies present the effects resulting from feeding punctures of aphids on eight species of plants, in which four species of aphids were concerned. The author finds that galls do not result from the punctures of the species studied.

"The path of the setal proboscis, as a rule, follows the middle lamella or is intercellular. The route followed by the proboscis is more or less sinuous and the various branches of the path indicate the trial and error method of reaching the bundle. The objective of the beak is always a vascular bundle. Within the bundle, the tissue which is most commonly reached is the phloem, particularly the sieve tubes. These sieve tubes may even become filled with sheath material from beaks which have pierced them and followed their course inside the tubes. In a few cases the setae pierced the tracheal tubes. Broken down phloem tissue was most common in *Digitalis purpurea*.

"Pierced epidermal and parenchyma cells may remain distended with the normal turgor or may collapse partially or wholly. Collapsed cells, contiguous to the setae but not actually pierced by them, are common in both cortical and bundle parenchyma in petioles of *Rumex crispus*. There is a tendency for the nuclei of living cells adjacent to the path to be located on the side toward the piercing setae. This condition exists in cells other than those immediately touched by the beak. The setal proboscis is surrounded by a sheath of calcium pectate and proteid material. The calcium pectate is evidently laid down by the plant cells, while the proteid material may possibly be injected by the aphid." A list of 13 references to the literature is appended.

**A note on the honeydew production of the aphid *Longistigma caryae*** Har., W. MIDDLETON (*Jour. Econ. Ent.*, 16 (1923), No. 5, pp. 446-448).—Investigations by the U. S. D. A. Bureau of Entomology of *L. caryae* at Washington, D. C., showed that it remained active, excreting honeydew, later in the year 1922 than had been previously recorded. Weather reports reveal late excesses of temperature associated with this record, and a brief summary of reports of the occurrence of the species with some extracts from literature are included in the account.

**Fighting pea aphids; effectiveness of aphidozer**, A. G. RUGGLES (*Canner*, 58 (1924), No. 6, pp. 23-26, figs. 6).—Work conducted in Wisconsin during the summer of 1923 is briefly reported upon. Tests of the mechanical effectiveness of an aphidozer led to the conclusion that further tests of this machine as a means of control of the pea aphid are justified and offer a fair promise of success.

**Tobacco dust as a contact insecticide**, P. J. PARROTT and G. F. MACLEOD (*Jour. Econ. Ent.*, 16 (1923), No. 5, pp. 424-430).—Data secured in experimental work by the authors at the New York State Experiment Station have led to the conclusion that the finer grades of tobacco dust, containing 1 per cent of nicotine, are highly toxic to the green peach aphid. Observations of the spirea plantings under treatment for this pest during the past two seasons indicate that timely applications of fine tobacco dust will afford adequate protection.

**Egg-killing washes**, A. H. LEES (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1922, pp. 58-61).—This is a report of a year's experimental work, which indicates that both lime sulphur and two proprietary fluids described have decided killing properties for eggs of the apple aphid.



**Contributions toward a monograph of sucking lice, III,** G. F. FERRIS (*Stanford Univ. Pubs., Univ. Ser., 2* (1922), No. 3, pp. 135-178, figs. 29).—In this continuation of the work previously noted (E. S. R., 46, p. 246), two genera are erected and eight forms are described as new.

**Life history of *Micromus posticus* Wlk.,** C. R. CUTRIGHT (*Jour. Econ. Ent., 16* (1923), No. 5, pp. 448-456).—This is an account of the life history and economic status of the hemerobiid larva *M. posticus*, which is predatory on aphids.

**Seasonal adaptation of a Northern Hemisphere insect to the Southern Hemisphere,** J. C. HAMLIN (*Jour. Econ. Ent., 16* (1923), No. 5, pp. 420-423).—The author discusses the adaptation of the pyralid *Melitara junctolineella* Hulst, an insect indigenous to North America that was introduced from Texas into Australia for the purpose of aiding in the control of prickly pear. The observed rapidity of development and the long summer of Queensland are said to strongly indicate that the final adaptation of the species to that environment will be three broods yearly, instead of two as occur in southwest Texas.

**The oriental peach moth (*Laspeyresia molesta* Busck),** B. TROUVELOT (*Rev. Zool. Agr. et Appl., 22* (1923), No. 1, pp. 14-22, figs. 2).—This is a summary of information on *L. molesta*, which was reported from Italy in 1921 (E. S. R., 47, p. 760) and was reported by the author from the region of Fréjus, France, in 1922 (E. S. R., 49, p. 555).

**Life history of the codling moth in Arkansas, with special reference to factors limiting abundance,** D. ISELY and A. J. ACKERMAN (*Arkansas Sta. Bul. 189* (1923), pp. 3-57, figs. 8).—This report of work conducted in cooperation with the U. S. D. A. Bureau of Entomology is reported under the headings of economic importance, synopsis of life history and seasonal history, weather during period of investigations, insectary methods, seasonal history, duration of stages, oviposition, seasonal and local variations in abundance, the forecasting of broods, and remedial measures. The investigations reported upon were conducted at Bentonville, during the seasons of 1918 to 1921, inclusive.

"During these four years, emergence of moths from the overwintering larvae began as early as April 13 and as late as April 30. The bulk of the emergence was always in May. Oviposition began from May 3 to 9, and hatching was consistently 8 days later. However, oviposition in 1919, the year for which the earliest record was secured, was checked by cold weather almost immediately after beginning, and continuous oviposition did not begin until May 25, the latest date for the four years. The bulk of oviposition usually occurred in a period of about three weeks in the latter part of May and the first few days of June. The bulk of hatching was from 5 to 7 days later.

"During the two years for which summer brood records were taken, emergence of first brood moths began June 15 and 24, oviposition began June 19 and 27, hatching began June 25 and July 3. During the remainder of the season the broods overlapped, and codling moth infestation increased until near the close of adult activity in September.

"The average duration of the different stages varied throughout the season with the variations in temperature. The average time required for the development of each stage at different periods of the season of activity is best indicated by the shortest and longest average for any 10-day period. The range of these averages is as follows: Egg stage 4.56 days in midsummer to 10 days in early spring; larval feeding period 16.14 days in midsummer to 31.42 days in late autumn; prepupal period, summer broods only, 3.50 days to 5.44 days; pupal stage 8.75 days in midsummer to 36.44 days in early spring; total period in cocoon, summer broods only, 13.56 days to 20.59 days. The preoviposition period is usually 2 days, and heavy oviposition is normally



passed by the end of the eighth day. The period of oviposition may be greatly lengthened by cold weather.

"The codling moth is very prolific during midsummer. During one 10-day period the average oviposition exceeded 110 eggs for each female moth. On the other hand, during the cooler part of the year, particularly in the spring, many moths fail altogether to deposit eggs. It has been found that light and temperature are important factors in limiting oviposition. At least partial darkness is necessary for heavy oviposition, and oviposition begins at a temperature above 62° F. This confines oviposition almost entirely to nights when the temperature is above 62° for at least a short period. The period of highest night temperature would normally be immediately after sunset."

A brief summary is given of remedial measures recommended. Spraying with lead arsenate at the rate of 1 lb. powdered to 50 gal. of water is the main dependence in codling moth control, a total of six or seven applications, as a rule, being necessary.

**Some notes on the relation of domestic animals to *Anopheles*, M. A. BARBER and T. B. HAYNE** (*Pub. Health Rpts. [U. S.]*, 39 (1924), No. 4, pp. 139-144).—The authors report observations on the relation of domestic animals to *Anopheles* in the United States under the headings of the attraction of man for *Anopheles* as compared with that of domestic animals, susceptibility to malaria parasites of *Anopheles* previously fed on pig blood, attraction of rabbits for *Anopheles*, and domestic animals as a factor in the production of *Anopheles*. The results of one experiment indicate that a feeding on a domestic animal will not affect the subsequent susceptibility of *Anopheles* to malaria parasites.

**Some observations on the dispersal of adult *Anopheles*, M. A. BARBER and T. B. HAYNE** (*Pub. Health Rpts. [U. S.]*, 39 (1924), No. 5, pp. 195-203).—This is a report of observations made by agents of the U. S. Public Health Service during the summers of 1920 and 1922 in a rice-growing region near Stuttgart, Ark., where *Anopheles*, especially *A. quadrimaculatus* were abundant.

"Nocturnal dispersion of *A. quadrimaculatus* from a resting place is nearly complete by the end of 6 days. When confined in such a resting place, mortality is very high, in our experiments nearly all were dead within 6 days. Longevity in midsummer and under natural conditions may be at least 25 days, but the proportion which could be recovered 3 days after staining was very small. *Anopheles* in effective numbers spread about a mile from rice fields into an open country."

**The breeding of *Anopheles maculipennis* Meig. in captivity, C. H. H. HAROLD** (*Jour. Roy. Army Med. Corps*, 41 (1923), No. 4, pp. 282-290).—The author reports at some length upon several experiments conducted. His observations indicate that successful mating depends upon the female obtaining a feed of blood as soon after emergence as possible.

**Delayed emergence of Hessian fly for the fall of 1922, W. B. CARTWRIGHT** (*Jour. Econ. Ent.*, 16 (1923), No. 5, pp. 432-435).—The author reports upon a delayed emergence of the Hessian fly which took place within a triangular area bounded by the Mississippi and Ohio Rivers and a line drawn eastward from St. Louis. Abnormal conditions of temperature and rainfall are said to have been the primary causes.

**Results of an oil spray in treatment of box leaf miner (*Monarthropalus buxi* Labou., J. K. PRIMM and E. A. HARTLEY** (*Jour. Econ. Ent.*, 16 (1923), No. 5, pp. 435-440).—A series of experiments conducted by the bureau of plant industry of the Pennsylvania Department of Agriculture indicate a limited usefulness for the molasses spray, while very satisfactory results were obtained with a heavy emulsifying petroleum oil, 1-20, and a pint of Blackleaf 40 to 50 gal. of spray, making one or two applications.

**The warble fly, its injury and control in Switzerland**, A. GANSSER (*Landw. Jahrb. Schweiz*, 37 (1923), No. 4, pp. 497-553, pl. 1, figs. 23).—This is an account of *Hypoderma bovis* and *H. lineatum*, their occurrence, biology, and means of control, which was presented before the Society of Naturalists in Basel in May, 1922.

**Transmission experiments on the specificity of *Herpetomonas muscae-domesticae* in muscoid flies**, E. R. BECKER (*Jour. Parasitol.*, 10 (1923), No. 1, pp. 25-34).—"The type of *Herpetomonas* known as *H. muscae-domesticae* was found to be entozoic in the alimentary canals of the muscoid flies *Musca domestica*, *Phormia regina*, *Lucilia sericata*, *Sarcophaga bullata*, *Cochliomyia macellaria*, and *Calliphora erythrocephala*. The flagellate from any one of these six species of 'wild' naturally infected flies was capable of producing a natural infection in the other five species of 'clean' laboratory bred flies when inoculated per os. That cross-infection was not due to accidental contamination was demonstrated by passing the parasites through a number of hosts of different species. Such infected flies are carriers capable of infecting other flies by fecal contamination of the food or proboscis of the fly. It is extremely probable that *H. muscae-domesticae*, *H. luciliae*, *H. calliphorae*, *H. sarcophagae*, and the *Herpetomonas* from *Phormia* and *Cochliomyia* flies all represent the same species."

**The relation of microorganisms to the development and longevity of flies**, R. W. GLASER (*Amer. Jour. Trop. Med.*, 4 (1924), No. 1, pp. 85-107, figs. 3).—This is a report of studies at the department of animal pathology of the Rockefeller Institute for Medical Research, at Princeton, N. J., made in connection with those on the effect of food on longevity, previously noted (E. S. R., 50, p. 456). The author finds the larval stages of flies to be dependent upon certain accessory growth factors which must be ingested with the food.

"These accessory growth factors are obtained by the larvae from bacteria or yeasts, as well as from higher plant and animal tissues. When rearing flies on media sterilized at high temperatures, the necessary growth factors for the larvae are destroyed, but can be replaced by contaminating the media with living bacteria or yeasts, by adding large quantities of dead bacteria or yeasts killed at low heat, or by adding fresh sterile animal tissue extracts or fresh, sterile plant juices. Nonpathogenic bacteria when ingested by adult flies shorten their life span and reduce the number of ovipositions. Microorganisms and their activities are not absolutely essential to the normal growth, development, and longevity of the flies investigated. Microorganisms are present in wild flies, especially in the larvae, because owing to their habits the ingestion of bacteria, yeasts, fungi, etc., can not be avoided. Microorganisms may be one of the principal sources for the accessory growth factors of some larval flies found breeding in certain types of media in a state of nature, but this assumption must not be regarded as a proved fact."

**The apple blossom weevil**, H. W. MILES (*Jour. Min. Agr. [Gt. Brit.]*, 29 (1922), No. 7, pp. 637-642, pl. 1).—Studies of the life history and habits of *Anthonomus pomorum* L., extending through two seasons and of control measures, are reported upon.

**Control of the apple blossom weevil**, H. W. MILES (*Jour. Pomol. and Hort. Sci.*, 3 (1922), No. 1, pp. 54-61).—A further report of the work noted above with particular attention to control measures.

**The apple blossom weevil: Its life history and control**, H. W. MILES (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1922, pp. 49-52).—The author gives a brief account of the life history of this weevil and of methods of control, based on the studies noted above. Studies of its life history have also been noted from another source (E. S. R. 50, p. 458).



**Bees and how to keep them**, C. B. GOODERHAM (*Canada Dept. Agr. Bul. 33, n. ser. (1923), pp. 60, figs. 53*).—This is a summary of information on apiculture.

**The normal and pathological histology of the ventriculus of the honey-bee, with special reference to infection with *Nosema apis***, M. HERTIG (*Jour. Parasitol., 9 (1923), No. 3, pp. 109-140, pls. 3*).—This account has been noted from another source (*E. S. R., 50, p. 156*).

**The value of hive and wild bees in the production of fruit**, C. H. HOOPER (*Fruit, Flower, and Veg. Trades' Jour. [London], 44 (1923), Nos. 20, pp. 580, 581; 22, pp. 633, 635*).—The author discusses the pollination of hardy fruits and the insects which visit fruit blossoms.

**The biology of two hymenopterous parasites of the grape pyralid (*Oenophthira pilleriana* Schiff.)**, P. VOUKASSOVITCH (*Compt. Rend. Acad. Sci. [Paris], 177 (1923), No. 19, pp. 906-908*).—This is a report of studies conducted during the summers of 1922 and 1923 in the region of Carbone (Haute-Garonne, France), where *O. pilleriana* has been present for some 12 years. The parasites reported upon, *Goniozus claripennis* (Först), a proctotrypid, and *Angitia fenestralis* (Holmgr.), an ichneumonid, have not been previously recorded as attacking this pest. *G. claripennis* is said to play an important part in the destruction of *O. pilleriana*, as high as 5 per cent having been observed to be destroyed by it in 1923, and 1 per cent by *A. fenestralis*.

## FOODS—HUMAN NUTRITION.

**The foods of France and its colonies**, A. BALLAND (*Les Aliments de France et des Colonies. Paris: J.-B. Baillière & Son, 1923, pp. 60*).—Proximate analyses are reported of various food materials of French origin, including cereals and grains, flours and starches, food pastes, breadstuffs, pastry, fresh and dried vegetables, fruits and fruit preserves, meats and fish, milk and milk products, soups, condiments, cocoa, coffee, and tea, and green and dried feeding stuffs.

**Nutrition problems during famine conditions in Russia**, B. SLOVZOV (*Nature [London], 112 (1923), No. 2809, pp. 328-330*).—A brief report is given of some of the nutrition investigations which were carried on in Russia during the postwar famine period.

Among the emergency substitutes incorporated in breads were various plants and roots. From metabolism experiments it was found that about 70 per cent of *Laminaria digitata*, 25 per cent of Iceland moss, and quantities up to 50 per cent of various green plants could be utilized by the system. In attempts to utilize bran, the bran was fermented with lactic organisms at from 40 to 45° C. for 15 hours, the process resulting in breaking up the cell membranes and rendering the cell contents more available. This was also accomplished by increasing the acidity of the bran by the addition of from 0.1 to 0.15 per cent of lactic acid and subjecting it to autolysis. Bread in which this autolyzed bran was incorporated is said to have been utilized from 5 to 6 per cent better than control bread, particularly with respect to its proteins.

In studies on the nutritive value of yeast, it was found that an adult can tolerate as much as 100 gm. of yeast daily without harm and with only a slight increase in the output of uric acid. Cultures of *Endomyces vernalis* under certain conditions were found to produce as much as 18 per cent of fat, calculated on the dry basis. This fat is said to consist chiefly of triglycerids, resembling olive oil in its composition, and to be well assimilated. As a practical means of cultivating the yeast for nutritional purposes, potatoes and other vegetables poor in fats and protein were sterilized and inoculated with the organism. After from 5 to 6 days' growth the medium was dried and used as food.

Interesting observations are also reported on the official rations for different classes adopted at various times and on the effect of the starvation diets. An outbreak of scurvy is reported to have occurred among groups of people whose diet was quantitatively satisfactory, but consisted chiefly of boiled millet, maize, etc. The lack of fats is thought to be responsible for various illnesses in infant institutions. A diminution in the fertility of women and the cessation of menstrual periods are also attributed to the faulty diet.

**Body weight and longevity** (*Metrop. Life Ins. Co., Statis. Bul.*, 3 (1922), No. 11, pp. 3, 4).—Attention is called to certain facts concerning body weight and longevity which have been derived from analyses of life insurance records.

It has been found that while in younger men an excess in weight over the average for height and age is an advantage, in men over 40 it is a decided disadvantage. In short men, below 5 ft. 7 in. in height, at the age period of 40 to 44 years an excess of 20 per cent in average weight for height is said to involve an added mortality of 30 per cent and an excess of 40 per cent in weight an added mortality of nearly 80 per cent. Among tall men (above 5 ft. 10 in.) at the same ages a 20 per cent excess in weight involves a 40 per cent increase in mortality and a 40 per cent excess doubles the mortality. During these same ages undeweight becomes a decided advantage.

"The important lesson taught by these propositions is that there is an optimum build with reference to mortality. The average build is not the best build. Those who weigh between 10 and 20 per cent below the average show the optimum condition of longevity at the most of the ages after early adult life."

**The importance of colostrum to the newborn infant**, A. KUTTNER and B. RATNER (*Amer. Jour. Diseases Children*, 25 (1923), No. 6, pp. 413-434).—The question of the importance of colostrum to the newborn infant, as suggested by the work of Smith and Little concerning its importance to the newborn calf (*E. S. R.*, 48, p. 86), has been considered through a study of the permeability of human placentas to diphtheria antitoxin and clinical observations on newborn infants who never received colostrum.

Evidence was obtained that, unlike the bovine placenta, the human placenta is permeable to immune substances. The concentration of antitoxin in the cord blood corresponded to that in the blood of the mother, showing no appreciable loss of antitoxin in passage through the placenta. The colostrum was invariably found to contain a much smaller amount of antitoxin than that found in the blood serum of the mother or in cord blood.

Clinical study of 18 infants known not to have received any colostrum showed no evidence of any harm as the result of artificial feeding.

These results are thought to indicate that in infant feeding colostrum has no significance as compared with its apparent importance in the feeding of the newborn calf.

**The inorganic constituents of human milk with particular reference to racial variations**, C. W. BURHANS and D. N. SMITH (*Amer. Jour. Diseases Children*, 26 (1923), No. 4, pp. 303-308).—Determinations of calcium, potassium, inorganic and total phosphorus, and chlorin are reported for 54 samples of human milk from colored, Jewish, Italian, Slavic, and native American women. The data are further grouped in averages for the white and colored races and in corresponding averages for different periods of lactation and different seasons.

The averages in milligrams per 100 cc. for white races and the colored race, respectively, were calcium 30.79 and 25.41 mg., potassium 50.38 and 53.18, inorganic phosphorus 5.45 and 4.8, total phosphorus 17.33 and 18.01, and



chlorids 43.79 and 57.02. The average periods of lactation were 16 weeks for the white and 22 for the colored women. The lower content of calcium in the milk of colored women was consistent in all cases. In only three specimens was the value higher than 30 mg. per 100 cc., while in three cases it was less than 20 mg. While there was more variation in the individual phosphorus content, 7 of the 8 samples having a content of less than 4 mg. of phosphorus per 100 cc. came from colored women. The chlorids averaged higher in late lactation than in mid-lactation.

The data, averaged by seasons, showed a possible decrease in the inorganic constituents, particularly calcium, in the latter part of the winter and early spring, but the number of cases is thought to be too small to justify any conclusions.

**A comparison of the value of milk and oranges as supplementary lunch for underweight children,** M. S. CHANEY (*Amer. Jour. Diseases Children*, 26 (1923), No. 4, pp. 337-348, figs. 2).—Observations are reported on the comparative value of oranges and milk in supplementary school lunches. The study was made at the Claremont School, Oakland, Calif. The children selected were all from middle-class homes and were 7 per cent or more underweight according to the Wood standards. The supplementary lunch was given on school days only, during the morning recess. No attempt was made to determine or alter the home diet, although at the end of the investigation a questionnaire was sent to each family concerning the amount of milk and oranges taken at home, and the cases receiving such supplements to the regular meals were dropped from the final record. The data obtained are given in the accompanying table.

Comparative gain of underweight children on supplementary lunches.

Lunch taken.	Winter term (8 weeks).				Spring term (8 weeks).			
	Num-ber of chil-dren.	Expected gain for each child.	Observed gain for each child.	Gain for each child above that expected.	Num-ber of chil-dren.	Expected gain for each child.	Observed gain for each child.	Gain for each child above that expected.
		<i>Kg.</i>	<i>Kg.</i>	<i>Per cent.</i>		<i>Kg.</i>	<i>Kg.</i>	<i>Per cent.</i>
Orange (1 medium size)...	10	0.579	1.397	141.27	38	0.529	1.152	117.76
Orangeade, $\frac{1}{4}$ pint.....	11	.599	1.122	87.31	30	.534	.945	76.96
Milk, $\frac{1}{2}$ pint.....	28	.458	.945	106.33	37	.509	.911	78.97
Milk, $\frac{1}{2}$ pint and orange...	26	.481	1.066	121.62				
Nothing.....	34	.537	.690	28.49	35	.544	.589	8.27

In addition to the food materials listed in this table, each child in all but the control group in both terms and the orangeade group in the winter term received 2 graham crackers daily. As shown by these data, the oranges brought about a greater gain than the milk. This is attributed to the fact that most of the children were getting an abundance of milk at home, while oranges were used less plentifully. The additional milk apparently had a slight depressing effect on the consumption of food at home, while the orange juice stimulated the appetite.

It is thought that oranges may well be substituted for milk in the supplementary feeding of children who have a natural aversion to milk, or who are found to eat less at the regular meals when milk is given between meals.

In connection with this study a comparison was made of the percentage underweight of the children under observation according to the Wood and

Pirquet standards. Many of the children who were decidedly underweight according to the Wood system and were apparently in a poor state of nutrition had high pelidisi values. The author is of the opinion that the Pirquet standard is inapplicable to American children.

**The effect of the spray process of drying on the vitamin C content of milk.**—A preliminary report, G. W. CAVANAUGH, R. A. DUTCHER, and J. S. HALL (*Amer. Jour. Diseases Children*, 25 (1923), No. 6, pp. 498-502, fig. 1).—In this reinvestigation of the question of the effect of the spray process of drying on the vitamin C content of milk, special care was taken to obtain the samples of raw and powdered milk from the same source. The milk was taken from the mixed milk of 175 dairies, representing 1,276 cows. The samples to be used raw were cooled and shipped to the laboratory in sterilized vacuum bottles, while more from the same lot was pasteurized under conditions known not to destroy vitamin C and then dried by the usual spray process.

Preliminary experiments showed a difference between the vitamin C content of winter and summer milk, but no appreciable difference between the raw and dried milk. A repetition of the experiment under more carefully controlled conditions as to standardization of the experimental guinea pigs led to the same conclusions. The animals were divided into six groups of 10 each, in addition to a control group of 5 receiving the basal diet alone. The average time for the onset of scurvy in the control group was 14.8 days, in the two groups receiving 20 cc. of raw and of powdered milk 18.4 and 20.3 days, respectively, and in those receiving 30 cc. 21.1 and 22.8 days. In the groups receiving 40 cc. of milk, 5 of the 10 receiving raw milk and 3 of those receiving powdered milk developed scurvy but all recovered. At the time of writing the experiment was in its sixty-first day, and was being continued to determine particularly the effect of aging on the vitamin C content of the milk.

**The presence of a yeast growth-promoting vitamin in cane sugar,** C. FUNK and L. FREEDMAN (*Jour. Biol. Chem.*, 56 (1923), No. 3, pp. 851-860).—The authors report a small but practically constant growth of yeast in successive transplants on the synthetic medium described by MacDonald (*E. S. R.*, 48, p. 760) when ordinary commercial sugar was used. On purifying sugar by recrystallization from alcohol or by shaking it with fuller's earth, growth on synthetic media containing the purified sugar was negligible. This is thought to prove that yeast, or at least the strain employed in this study, is unable to grow in the total absence of vitamin D, and that consequently yeast can not synthesize vitamin B in the absence of vitamin D.

**Can the checking of growth from lack of vitamins be compensated by inorganic substances?** G. SUDA (*Biochem. Ztschr.*, 138 (1923), No. 1-3, pp. 269-273).—Attempts are reported to compensate for the lack of vitamins in the diet of mice by the addition of suitable amounts of arsenic acid, from 0.15 to 0.8 mg. per kilogram of body weight. This supplement was found to be without effect upon the weight of the pigeons on the normal and vitamin-free diets.

**The compensatory influence of ultraviolet light on the avitaminous disturbances in the bone marrow,** ISHIDO (*Biochem. Ztschr.*, 137 (1923), No. 1-3, pp. 184-192, figs. 4).—Attention is called to previous observations that ultraviolet light has a favorable action on bone marrow through increasing the number of cells and preventing the deposition of fat. The possibility is suggested that the therapeutic action of ultraviolet light in rickets is due to increased cell production in the bone marrow.

To test this hypothesis a group of 15 rats about 16 weeks of age was selected. Of these 9 were fed on polished rice and salt mixture and the remainder on kitchen scraps and salt mixture. Of the first group 5 and of the second 3 received ultraviolet light treatment for from 3 to 10 minutes a day.



The animals were killed at varying intervals, and examination was made of the bone structure and marrow of the femur and tibia.

In the normally-fed animals the principal difference between those not receiving and those receiving light treatment was an increase in erythroblasts and a decrease in erythrocytes in the latter, with slight hyperemia after prolonged treatment. There was little fatty tissue in both groups. Of the animals on the vitamin-deficient diet, the bone marrow of those receiving light treatment was practically normal with the exception of marked hyperemia, while in those not receiving light treatment there was a marked deposit of fat in the bone marrow.

**On the behavior of platelets in vitamin A deficiency and on the technique of counting them,** W. CRAMER, A. H. DREW, and J. C. MOTTRAM (*Brit. Jour. Expt. Path.*, 4 (1923), No. 2, pp. 37-44).—This is essentially a reply to the paper of Bedson and Zilva (*E. S. R.*, 49, p. 562), in which they reported a much higher blood platelet count in animals on a vitamin A-deficient diet than did the present authors (*E. S. R.*, 49, p. 61). This discrepancy in results is explained on the ground of faulty microscopic technique on the part of the above-named authors. A detailed account is given of the technique of platelet counting, with special reference to the microscopic technique required to obtain reliable results. Further data are given confirming the authors' previous conclusions that a diet free from vitamin A produces marked thrombopenia.

**Investigations on the residual nitrogen content of the blood in avitaminous and starving pigeons,** D. ALPERN (*Biochem. Ztschr.*, 138 (1923), No. 1-3, pp. 142-149, figs. 2).—A comparison is reported of the residual and amino acid nitrogen content of starving pigeons and of pigeons maintained on a diet of polished autoclaved rice. A striking similarity is shown in the curves representing these values in successive periods, the tendency being to an increased content of nitrogen with periodic fluctuations. These results are thought to furnish evidence that avitaminosis is a type of chronic starvation.

**The significance of vitamins in the exchange of the animal body.—II, The course of experimental avitaminosis in partial starvation,** L. TSCHERKES (*Biochem. Ztschr.*, 137 (1923), No. 1-3, pp. 121-124, figs. 1).—In continuation of the series of studies previously noted (*E. S. R.*, 49, p. 364), a single experiment is reported in which two pigeons were fed heated sunflower oil and two heated barley, both in amounts sufficient to furnish only 50 per cent of the caloric requirement. A fifth pigeon received unheated barley to the extent of 50 per cent of its caloric requirement.

The two fed heated barley died on the tenth and fourteenth days without showing signs of polyneuritis, those fed the sunflower seed oil on the twenty-second and twenty-third days with symptoms of polyneuritis, and the control on the thirtieth day. These results are interpreted as furnishing evidence that carbohydrates and proteins hasten the progress of avitaminosis in partial starvation, as well as in cases of excessive caloric consumption. The absence of polyneuritic symptoms in the two pigeons on heated barley is explained on the ground that a certain time is required before the appearance of characteristic symptoms of polyneuritis, and that as the result of a deficiency in both vitamins and calories death ensues before sufficient time has elapsed for the appearance of these symptoms.

**On vitamin underfeeding,** W. CRAMER (*Brit. Jour. Expt. Path.*, 3 (1922), No. 6, pp. 298-306, fig. 1).—This is a general discussion, illustrated by observations from the author's laboratory, of the effects of a deficiency, though not a complete lack, of vitamins in the diet.

Attention is first called to the differences observed between a stock of rats kept on a diet of bread and water supplemented with boiled corn and rice and of others kept on this same diet supplemented with materials rich in vitamins A and B. It is stated that on the first diet the animals were apparently normal in health and bred freely, but that the rate of growth was not normal, animals of a certain age sometimes being only half as large as those of a corresponding age on the vitamin-rich diet. It is suggested that "large classes of civilized mankind live on diets of a correspondingly restricted vitamin content, adequate to prevent obvious ill health but not adequate to insure the maximum development."

To test the effect of vitamin underfeeding in pregnancy and lactation, several female rats which had not attained their full growth were kept together with male rats on the laboratory diet described above, while others, or in one or two cases the same animals at earlier or later periods, received the same diet supplemented with marmite as a source of vitamin B and cod liver oil as a source of vitamin A. Data were obtained on the weight of the mother at conception and after littering, with the loss or gain during pregnancy and lactation, and on the total weight and number of young of each litter. In all, four complete observations were made for animals on the laboratory diet and six on the enriched diet.

The tabulated data show that on the laboratory diet there was either a small gain in weight or none at all during pregnancy and a decided loss during lactation, while on the vitamin-rich diet there was a decided gain in weight during pregnancy and in most cases a slight loss during lactation. Combining the periods of pregnancy and lactation, the weight of the mothers remained practically unaltered on the vitamin-rich diet, but showed a considerable loss on the laboratory diet. No significant differences were noted in the weight or number of the young.

The effect of vitamin underfeeding in infants is illustrated by the weight curves of 6 rats from 2 litters kept in the same cage on a diet free from vitamin A. Three of the animals belonged to a litter taken from a vitamin-underfed stock and had been kept from birth on the laboratory diet, while the other 3 belonged to a litter from a stock on this diet enriched by marmite and cod liver oil and had been kept from birth on this diet.

In the former case the animals ceased to grow almost immediately, 2 developed keratomalacia within 8 or 9 weeks and died, and the third died of pneumonia in the ninth week, while the rats from the other litter continued to grow and remain well during the 20 weeks of the experiment, although receiving no vitamin A. In this connection, it is stated that sometimes animals from a vitamin-rich stock may grow even more rapidly when placed on a vitamin-free diet than animals from a vitamin-underfed stock when placed on a vitamin-rich diet.

"These conclusions open up a social aspect of the vitamin problem which has hitherto not been recognized, but which is at least as important as the actual production of diseases by a severe vitamin deficiency. They suggest that the physical make-up of a community is determined largely by the ease and regularity with which an abundant supply of vitamins is secured to the pregnant and nursing mother and to the growing child."

**The effect of experimental rickets upon the weights of the various organs in albino rats,** C. M. JACKSON and R. CARLETON (*Amer. Jour. Physiol.*, 65 (1923), No. 1, pp. 1-14).—The weights of various organs of 81 rachitic rats between 2 and 3 months of age and 30 and 75 gm. in weight were subjected to statistical analysis by comparing the weight of each organ with the norm for corresponding body length, as determined from Donaldson's tables. Similar



comparisons with these norms were made with data obtained from 37 normal controls of the same weight. The percentage deviation from the normal for each individual organ was then calculated for both test rats and controls, and these deviations were compared to determine whether the apparent changes in the test rats were due to the conditions of the experiment or were found in normal controls.

From the data as thus analyzed, the various organs and parts of the body in experimental rickets are grouped as follows: Those showing a definite decrease in weight include the integument, hypophysis, dry skeleton, empty stomach and intestines, and especially the thymus. Organs showing an increase in weight include the eyeballs, heart, gastrointestinal contents, and especially the submaxillary glands, kidneys, and suprarenal glands. Those showing only slight or irregular changes include the head, ligamentous and moist cartilaginous skeleton, musculature, brain, lungs, liver, spleen, ovaries, testes, and epididymides.

**Studies of rickets in Vienna, 1919-1922** ([*Gt. Brit.*] *Med. Research Council, Spec. Rpt. Ser., No. 77* (1923), pp. [2]+230, pls. 20, figs. 101).—This is the complete report of the investigation on rickets conducted in Vienna from 1919 to 1922 and which has previously been noted from preliminary reports. Following a preface by C. Pirquet, director of the Kinderklinik at which most of the studies were made, the report is presented in six parts as follows:

Part I consists of a brief historical introduction dealing more especially with various theories which have been advanced concerning the etiology of the disease. Part II, by H. Chick et al., deals with general observations upon the prophylaxis and cure of rickets at the University Kinderklinik, Vienna, and has been essentially noted from a preliminary report (*E. S. R.*, 48, p. 64). Part III deals more especially with the clinical aspects of rickets in the following papers: A Study of Developing, Florid, and Healing Rickets as Demonstrated by X-ray Photography, by H. Wimberger; Observations on Infantile Rickets at the Landes Zentral-Kinderheim, Vienna; Prophylactic Treatment in a Large Institution, by M. Zarfl, E. J. Dalyell, and H. M. M. Mackay; Notes on the Clinical Signs of Infantile Rickets as Observed in Vienna and Histological Investigation of the Significance of Enlarged Costochondral Junctions, both by Dalyell and Mackay.

Part IV consists of the report of a special study, conducted under the direction of E. M. Hume, of the vitamin A value of human milk and cow's milk under varying conditions and of the interaction between vitamin A and light in the growth of rats. The papers comprising this report, with the principal results obtained, are as follows:

(1) Routine Tests of the Vitamin A Value of the Milks Used for Infants in the Observations on Prophylaxis and Therapy of Rickets and the Effect on Vitamin a Value of the Milk of Certain Alterations in Diet and Environment of the Cow, by Hume. Tests were made of the vitamin A value of the various milks used in the investigation proper as reported in Part II. These included a dried milk prepared from the milk of grass-fed cows; fresh milk from the largest Vienna dairy company and representing mixed milk from many herds, mostly stall-fed; milk from cows stall-fed on a controlled ration of grain, chaff, and roots; milk from cows on a controlled ration of hay, clover, and roots, and later green fodder; and milk from a single cow on the controlled ration of grain, chaff, and roots, but exposed daily to the sun.

Both the dried milk and the ordinary milk from the Vienna milk supply were of low vitamin A values, the latter remaining so throughout the year. The vitamin A value of the milk of cows on the controlled ration without fresh green stuff was also low and of constant value. No appreciable improve-



ment was noted in the vitamin A content of the milk as the result of feeding the cows intensively with fresh green food, nor was there any improvement as the result of exposing the cow daily to the direct rays of the sun.

(2) Investigation of Human Milks for Value in Vitamin A and Attempts to Modify that Value by Special Feeding of the Mother, by Hume. In this investigation a comparison was made between the vitamin A value of samples of human milk as determined by feeding experiments with rats and guinea pigs and the condition with respect to rickets of infants receiving the milk. Observations were also made of the effect on the composition of the milk of alterations in the mother's diet.

In general, the milk of women with rachitic children was found to be of poor growth-promoting power for guinea pigs and of low vitamin A value as tested on rats, while the milk from mothers of nonrachitic children or children with only slight rickets had better growth-promoting property for guinea pigs. The addition of butter or margarin prepared from animal fats to the diet of mothers yielding milk of low vitamin A value had little or no effect upon the milk, but the administration of cod liver oil produced an effect after a considerable time in some cases and very rapidly in others. The variation in the effect of cod liver oil is attributed to the condition of the mothers. In the case of well-nourished women the fat-soluble vitamin appeared to be transferred rapidly to the milk, but in ill-nourished women, who were probably in a state of extreme vitamin A depletion, the vitamin was retained in the body.

(3) The Effect of Radiation with the Mercury Vapor Quartz Lamp on the Growth of Rats Fed on a Diet Deficient in Vitamin A, by Hume, previously noted from another source (E. S. R., 49, p. 60).

(4) The Effect of Air Irradiated by the Mercury Vapor Quartz Lamp on the Growth of Rats Fed on a Diet Deficient in Vitamin A, by Hume and H. H. Smith previously noted from another source (E. S. R., 50, p. 265).

Part V consists of a discussion on hunger-osteomalacia in Vienna in 1920, which has been previously noted from another source (E. S. R., 46, p. 568).

In Part VI, which closes the report, the principal conclusions drawn from the investigation as a whole are summarized and discussed, particularly with relation to experimental work on rickets in animals and to the various theories concerning the etiology of rickets which were discussed in the introduction. The results obtained are considered to emphasize "(1) the importance of diet for prophylaxis of rickets in winter, (2) the lesser importance of diet for prophylaxis in summer, (3) that exposure to sunlight or to radiations from the mercury vapor quartz lamp can to some extent compensate for a defective diet, and (4) that the seasonal incidence of rickets is satisfactorily accounted for by variation in the amount of exposure to light."

The general conclusion drawn is that "the problem of the etiology of rickets is approaching solution, but the interplay of the various factors influencing the satisfactory deposition of calcium phosphates in the growing skeleton is still obscure. Until this chapter in metabolism is known in greater detail, there will be room for much divergence of opinion as to which is the more important factor in determining the occurrence of rickets.

"As long as rickets was regarded by some as an infective disease of unknown origin and by others as attributable to undefined defects in diet or hygiene, efforts toward prevention were imperfectly orientated. The present position is very different. The facts derived from clinical and epidemiological observations and from animal experiment are now beginning to fit together into a coherent interpretation of the disease. Already sufficient sanction is provided for preventive and curative measures against one of the most widespread and most damaging diseases to which an industrial population is subject."



The report is abundantly illustrated with charts and photographs, and many references to the original literature are included.

**On glycolysis in diabetic and nondiabetic blood**, W. DENIS and U. GILES (*Jour. Biol. Chem.*, 56 (1923), No. 3, pp. 739-744).—Data are reported indicating that glycolysis in normal blood is much more active than in the blood of persons suffering from fairly severe diabetes. "These findings are explained on the assumption that in normal subjects the 'blood sugar' consists of  $\gamma$ -glucose which is readily attacked by the glycolytic enzym, while in persons suffering from severe diabetes probably only a small portion of the reducing bodies consists of  $\gamma$ -glucose, the main portion being the  $\alpha$   $\beta$  form which the glycolytic enzym is powerless to attack. The amount of glycolysis obtained bears no relation to the concentration of the blood sugar."

**Effect of acidification on toxicity of *Bacillus botulinus* toxin**, J. C. GEIGER and W. E. GOUWENS (*Pub. Health Rpts. [U. S.]*, 38 (1923), No. 39, pp. 2249-2252).—Contrary to the statement of Bronfenbrenner and Schlesinger (*E. S. R.*, 46, p. 669) that the toxicity of *B. botulinus* is increased by acidification, the authors report that toxins of four strains of *B. botulinus* were not increased in potency by acidification, the acid mixtures employed being hydrochloric acid-sodium citrate and acetic acid-sodium acetate mixtures. Further investigation showed that acetic acid appears to have a selective toxic action for white mice. The injection of 1 cc. of a buffered acetic acid of pH 4 caused the death of mice whether *B. botulinus* toxin was present or absent. With greater concentration of H-ions death was more rapid.

## ANIMAL PRODUCTION.

**The statistical significance of experimental data**, E. B. WILSON (*Science*, 58 (1923), No. 1493, pp. 93-100, figs. 2).—The mathematical determination of the significance of experimental data, based on the relative size of the probable error, is discussed. The importance of the choice of animals for feeding experiments and the use of scientific judgment along with the application of statistical methods are emphasized by the statistical treatment of data showing the results of feeding experiments with guinea pigs to test the vitamin C content of milks differently treated.

**The chemical basis of growth and senescence**, T. B. ROBERTSON (*Philadelphia and London: J. B. Lippincott Co.*, 1923, pp. VIII+389, pls. 5, figs. 40).—This monograph on the chemical basis of growth and senescence includes discussions of the cycles of growth in man, animals, and plants; reproduction in unicellular organisms; inorganic salts, amino acids, and accessory food factors as fundamentals for growth; retardation of growth and relation of the nutrient level to growth; differentiation and development; hyperdifferentiation of tissues (cancer); and growth and evolution. A chapter also deals with the influence on growth of special agents such as lecithin, cholesterol, the anterior lobe of the pituitary body, tethelin, and thyroxin. The appendix consists of tables and methods for the computation of curves of autocatalysis. A bibliography of 538 references is also given.

**Age and chemical development in mammals**, C. R. MOULTON (*Jour. Biol. Chem.*, 57 (1923), No. 1, pp. 79-97, figs. 11).—The percentage composition in water, nitrogen, and ash of the fat-free bodies of man, cattle, swine, dogs, cats, rabbits, rats, and mice of various ages are presented as they have been collected from various sources. All the animals tend to show a rapid decrease in concentration of water, with a similar increase in nitrogen and ash, from the time of conception until chemical maturity is reached at varying ages after birth, depending upon the development of the young at birth. After chemical

maturity is reached little change in the chemical composition of the fat-free body seems to occur. The animals are grouped according to development at birth. Group 1 includes guinea pigs and cattle, which show the most development at that time, and group 2 man, the pig, the dog, and the cat, which have a similar chemical composition at birth and which show less development than the animals in group 1. Group 3 includes the rat and mouse, which exhibit the least development and have the highest water content at birth. The rabbit seems to fall between classes 2 and 3.

The relation of the length of the gestation period to the relative development at birth is discussed, and the guinea pig and man are noted as outstanding exceptions to the other animals. The table below shows the estimated conceptional ages of the various mammals at different stages in their life cycles, based on data from other sources. The data indicate that the age at chemical maturity bears a nearly constant relation to the total length of life in the different animals.

Relations between life cycles and chemical composition in various mammals.

Species.	Average length of gestation period.	Approximate length of life.	Conceptional age at maximum of third growth cycle. <sup>1</sup>	Conceptional age at chemical maturity.	Age at chemical maturity to total life.	Composition at birth.		
						Water.	Protein.	Ash.
	Days.	Years.	Days.	Days.	Per cent.	Per cent.	Per cent.	Per cent.
Cattle.....	285	25	850	435	4.6	76.3	18.4	4.56
Guinea pig.....	64	7	145	114	4.6	77.8	16.8	3.76
Man.....	285	80	5,300	1,285	4.4	82.0	14.0	3.00
Swine.....	120	20	200?	270-420	4.6	82.0	12-13	3.00
Dog.....	61	17	-----	261	4.3	82.0	13-14	2.00
Cat.....	60	11	-----	160?	3.9?	83.0	13-14	2.50
Rabbit.....	31	10	185	-----	-----	84.0	13	2-3
Rat.....	25	3-6	86	75	4.5	88.0	9.6	1.5
Mouse.....	20	3-6	62	-----	-----	86-87	11.0	1.7

E. S. R., 48, p. 660.

Studies in inorganic metabolism.—I, II, B. SJOLLEMA (*Jour. Biol. Chem.*, 57 (1923), No. 1, pp. 255-284, figs. 3).—Two studies are reported.

I. *The influence of cod liver oil upon calcium and phosphorus metabolism.*—Two experiments are reported dealing with the effects of cod liver oil on the calcium and phosphorus metabolism in rabbits. During the first experiment, which was divided into 3 periods of 19, 18, and 15 days, respectively, a ration low in calcium was fed to 2 rabbits, but during the second experiment, which was divided into 3 periods of 14 days each, a supplement of calcium acetate supplying 40 mg. of calcium daily was fed to the 1 rabbit used in this test. The daily ration for each rabbit consisted of 20 gm. of wheat kernels, 3 gm. of butter, and 60 gm. of a mixture of purified casein, oat straw, dextrin, lactose, and various salts, as well as 15 gm. of cabbage. Any feed that was not consumed by the rabbits was weighed back. During the second period of both experiments 1 gm. of cod liver oil was given to each animal daily. The table following summarizes the results obtained in the two experiments.



Calcium and phosphorus metabolism as influenced by the daily administration of 1 gm. of cod liver oil in the second period of each experiment.

Ex-periment.	Pe-riod.	Rab-bit num-ber.	Average daily—									
			Cal-cium in-take.	Calcium output.		Cal-cium bal-ance.	Vol-ume of urine.	Weight of air-dried feces.	Phos-phoric acid intake.	Phosphoric acid output.		Phos-phoric acid bal-ance.
				In urine.	In feces.					In urine.	In feces.	
			Mg.	Mg.	Mg.	Mg.	Cc.	Gm.	Mg.	Mg.	Mg.	Mg.
1	1	1	25.37	5.00	32.70	-12.33	37.2	5.037	531	198.0	159.0	+174
1	2	1	27.57	3.20	11.86	+12.50	20.8	3.33	481	121.3	83.0	+276.7
1	3	1	23.82	9.47	26.64	-12.28	31.0	4.787	438	164.4	159.6	+114
1	1	2	27.47	5.00	70.00	-47.6	39.1	7.875	584	134.0	384.0	+66
1	2	2	20.03	3.64	18.85	+5.6	38.7	4.49	494	241.0	127.0	+126
1	3	2	20.1	7.00	16.6	-3.5	47.2	2.4	318	179.0	84.0	+55
2	1	1	65.23	18.62	25.4	+21.21	25.6	4.66	497.6	191.0	157.0	+150
2	2	1	60.25	2.16	22.95	+35.15	14.7	4.28	415	65.5	125.0	+225
2	3	1	59.0	8.24	30.4	+20.4	65.0	5.62	455	202.0	165.0	+88

The data in the table clearly show that an increased calcium balance was maintained when cod liver oil was fed. The author concludes that with diets low in calcium the cod liver oil diminished the production of feces, but with diets high in calcium the production of urine was principally reduced. A fairly uniform ratio of calcium to phosphorus was observed in the feces in nearly all cases except when cod liver oil was fed. The importance of calcium for the proper functioning of the intestine is emphasized by the fact that in times of negative calcium balance it was apparently easier to excrete calcium from the bones than to produce feces with a low calcium content.

II. *The influence of crude fiber and of protein upon calcium and phosphorus metabolism.*—In view of the results obtained in regard to the calcium content of the feces in the above paper, two experiments were carried on with one rabbit to determine if feeding large amounts of crude fiber would lower the calcium balance. The feeds used were the same as in the above test except that mangels, carrots, and carrot tops replaced the cabbage in the first experiment.

The first experiment consisted of 5 periods of 14 days and 2 periods of 7 days each. During the first period the ration contained 3 per cent of oat straw and during the seventh period 3 per cent of sawdust. In the third, fourth, and fifth periods additional roughage was added so that the ration contained 10 per cent of oat straw and 5 per cent of sawdust. In periods 2 and 6 (7 days each) gradual changes were made from the low to the high roughage content ration and vice versa, respectively. Supplements of 40 mg. of calcium were supplied in periods 1, 2, 3, 4, and 5, as well as 10 per cent of wheat gluten in period 4 and 0.18 gm. of cystin in periods 4 and 5. During periods 6 and 7 15 mg. of calcium were fed daily.

The second experiment consisted of 3 14-day (1, 3, and 5) periods and 2 7-day periods. In periods 1 and 5 roughage in the form of oat straw made up 3 per cent of the ration, and supplements of 12.7 mg. of calcium were fed per day. In period 3 the ration contained 15 per cent of oat straw without calcium supplement. Gradual changes in the ration from periods 1 to 3 and 3 to 5 were made during periods 2 and 4, respectively.

The average daily calcium balances in the first experiment were in periods 1, 3, 4, 5, and 7 +20.4, -43.2, -8.6, -25, and +18.5 mg., respectively. The weights of the air-dried feces produced daily in the respective periods were 5.62,

11.87, 9.8, 10.5, and 3.34 gm. In the second experiment the average daily calcium balances during periods 1, 3, and 5 were respectively,  $-59.7$ ,  $+69.4$ , and  $+6.77$  mg., and the feces produced 3.62, 7.72, and 3.85 gm. The results of the first experiment, when a high calcium diet was fed, indicate that the high fiber diet lowers the calcium balance by causing a large secretion of feces which maintain a fairly constant calcium content. In the second experiment the results were not so clear, but with the low calcium ration the calcium content of the feces decreased from 1.2 to 1 per cent and of the urine 64 to 15.5.

The high protein diet of wheat gluten tended to reduce the fecal calcium production by reducing the amount of feces. The amount of urinary calcium, however, was practically the same. The phosphorus metabolism did not necessarily follow the calcium, but some of the same factors that affect the calcium had an indirect influence on the phosphorus, though the calcium and phosphorus metabolisms were independent of each other. Phosphorus does not seem to play the same constant rôle in the intestines as calcium.

Another interesting point brought out in the investigation was the fact that the male rabbit used for a whole year on experiments in which rations supplying inadequate amounts of calcium were fed was apparently infertile when mated. This rabbit finally died of liver cirrhosis, which the author states may have been due to the deficient calcium diets.

**The net energy value of beets and barley for feeding purposes, and the significance of the nutritive ratio in relation to the feeding value of these feeds,** H. MØLLGAARD (*Beret. Forsøgslab. K. Vet. og Landbohøjskoles [Denmark]*, 111 (1923), pp. [3]+159, fig. 1).—The results of 25 metabolism experiments with cattle carried on in accordance with the principles of Armsby and Fries are presented in tabular form. The feeds used in the rations consisted of straw and soy bean meal, with the addition of beets or barley. The results showed that the net energy value of the beets was dependent upon the protein content of the total ration, since the beets are deficient in protein. The net energy value of feeding stuffs deficient in protein is thus apparently limited by the protein content of the total ration. Maximum gains resulted with nutritive ratios of 1:5.

A consideration of the metabolism while standing and while lying down has led the author to conclude "that the correction of metabolism to uniform standing and lying introduced in physiology of nutrition by Armsby and Fries is evidently not supported by convincing facts and is, therefore, not to be applied to the computation of metabolism experiments."

In studying the ratio of metabolizable energy in digestible organic matter, the author states "that his experiments affirm Kellner's idea, that the metabolizable energy of mixed feed has a constant proportion to the digestible organic matter of feed, but that they do not support Armsby's further conclusion, that the metabolizable energy of a single feeding stuff has a constant value computed in proportion to the digestible organic matter."

An English summary of the conclusions and English translations of the tabulated results of each experiment are given.

**Losses and exchanges of material during the storage of corn as silage,** A. E. PERKINS (*Ohio Sta. Bul. 370* (1923), pp. 291-306).—The composition of corn silage when put in the silo and as fed from two silos during the years 1916 to 1921 is reported. In some of the experiments in which the grain was sorted from the silage and analyzed, it was found that the grain, especially the broken kernels, had lost a considerable portion of its protein, which was recovered in the juice of the silage as the products resulting from protein hydrolysis. The protein content of the silage was increased in many cases, probably due to a reduction in the other constituents through fermentation. In



view of the transfer of nutrients, especially proteins from the grain to the juice, any loss of juices should be carefully prevented. The comparative analyses of the different samples are tabulated in detail.

**The vitamin content of fish meal, tankage, and blood meal**, G. BOHSTEDT ET AL. (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 11-12, pp. 167-169).—The results of a series of tests with rats have indicated that fish meal, tankage, and blood meal are deficient in both vitamins A and B when fed as 1, 4, and 8 per cent, respectively, of the ration.

**Inspection and analyses of feeds**, W. H. STROWD (*Wis. Dept. Agr. Bul.* 52 (1922), pp. 82-97, 98, fig. 10).—This is a report of the results of the official analyses of feeds in Wisconsin for the years 1921 and 1922. It consists mainly of a discussion of the standards for wheat mill feeds, based chiefly on the average protein, fat, and fiber analyses of the different wheat mill feeds from 1908 to 1920.

**The founders of our principal industry**, R. HOGG (*An. Soc. Rural Argentina*, 57 (1923), No. 16, pp. 620-657, figs. 54).—This deals with the history of livestock production in Argentina, discussing the influence of various individuals in its development.

**The evolution of breeds**, D. F. MAIN (*Des Moines, Iowa: Wallace Pub. Co.* 1923, pp. XVI+278, figs. 44).—The development of Shorthorn, Hereford, and Aberdeen-Angus cattle and Poland-China and Duroc-Jersey hogs is historically reviewed, with descriptions of the pedigree of the more outstanding sires of each breed. The book ends with a discussion of breed building in the future, in which the practical value of the results of scientific investigation in animal breeding is emphasized.

**Carrying out and calculating metabolism experiments with ruminants**, A. C. ANDERSEN (*Biochem. Ztschr.*, 130 (1922), No. 1-3, pp. 143-150).—This is essentially a description of a method previously noted (*E. S. R.*, 48, p. 871).

**Beef production in the Cotton Belt**, A. T. SEMPLE (*U. S. Dept. Agr., Farmers' Bul.* 1379 (1923), pp. II+19, figs. 5).—This is a practical discussion of the recommended methods of beef cattle raising in the Cotton Belt.

**Winter feeding of beef calves**, S. BALLANTYNE (*Canada Expt. Farms, Kapuskasing, (Ont.) Sta. Rpt. Supt.* 1922, p. 21).—To compare oats, peas, and vetch silage with roots in a ration containing clover hay and meal for wintering beef calves, 6 grade Shorthorns were selected and divided into two lots, one type of succulent feed being fed to each lot beginning on November 15. At this time the lot receiving the oats, peas, and vetch silage averaged 549.3 lbs., whereas the lot receiving roots averaged 587.7 lbs. During a 5 months' feeding period average daily gains of 1.07 and 0.91 lbs., respectively, were made by the two lots at calculated feed costs per pound of gain of 12.9 and 14.1 cts.

**[Kansas ration tests with lambs]** (*Natl. Wool Grower*, 13 (1923), No. 9, p. 25).—In the winter of 1922-23 different feeds were compared for fattening lambs at the Kansas Experiment Station. The basal ration used consisted of shelled corn, cane silage, alfalfa hay, and cottonseed meal. Lambs receiving this ration or with kafir heads replacing the corn made average daily gains per head of 0.2 lb. more per day than when whole or ground kafir replaced the corn. The finish of the lots on the basal ration was slightly better, and the calculated profit per lamb was a little larger. Rations containing sweet clover in place of alfalfa hay produced equal gains, but the calculated returns per lamb were much less when the sweet clover was fed. A comparison of sweet clover with and without cottonseed meal when silage was fed showed that the cottonseed meal ration produced about 0.2 lb. more gain per day, but the profit was less than when no cottonseed meal was fed.

**Economical rations for wintering ewe lambs,** W. E. JOSEPH (*Natl. Wool Grower*, 13 (1923), No. 9, pp. 21-23, figs. 3).—In comparing the feeding value of hay, oat straw, oats, and wheat screenings for wintering pregnant ewe lambs at the Montana Experiment Station, 380 head which had been uniformly fed for about one month were divided into 3 lots for a 119-day test. Lot 1 received an average daily ration of 2.95 lbs. of alfalfa hay, lot 2 1.86 lbs. of alfalfa hay and 0.31 lb. of oats, and lot 3 received an average daily ration of 1.39 lbs. of alfalfa hay, 0.8 lb. of oat straw, and 0.65 lb. of wheat screenings. All lots made average gains per lamb during the test of approximately 12 lbs. The daily costs of the ration per head were calculated at 1.47 cts. with hay alone, 1.43 with oats and hay, and 1.1 cts. with wheat screenings, oat straw, and hay.

In a trial with wethers fed on wheat screenings, the germination ability of practically all the weed seed in the manure from these wethers had been destroyed.

[**Nebraska ration tests with lambs**] (*Natl. Wool Growers*, 13 (1923), No. 9, pp. 23-25).—An 84-day feeding test with lambs is reported in which 9 lots of 30 lambs, averaging 61 lbs. each, were employed at the Nebraska Experiment Station. The rations fed consisted of shelled corn and alfalfa hay as a basis in all but lot 2, where small amounts of oats were fed during the first 5 weeks, and in lot 6, where prairie hay replaced the alfalfa hay, and a heavy feed of linseed oil meal was also given. In lots 3, 4, and 5, respectively, light, medium, and heavy feeds (0.14, 0.20, and 0.23 lb. per day) of linseed oil meal were furnished and in lots 7, 8, and 9 light, medium, and heavy feeds of cottonseed meal were included.

The average daily gains made by the lots 1 to 9 in numerical order were, respectively, 0.289, 0.284, 0.327, 0.329, 0.331, 0.26, 0.311, 0.337, and 0.326 lb. The calculated profit per head was highest in lot 1, \$1.57, followed by lot 3, \$1.38. The least profit per head occurred in lot 6, 58 cts., followed by lot 8, 83 cts.

**The body development of domestic goats,** P. HELFERT (*Landw. Jahrb.*, 56 (1921), No. 4, pp. 605-646, figs. 15).—The weights and body measurements of two groups of Saanen goats ranging in age from 4 weeks to 3 years are recorded.

The growth rate of the bucks was found to be quite different from the growth rate of the does, though both made the greatest proportionate growth during the first 3 months in height, length, breadth, and weight. The growth rate from 3 to 6 months was about one-half that during the previous 3 months' period. The bucks made uniform growth in height, length, and breadth, but the does increased more in breadth during this period. From 6 months to 1 year, growth was more pronounced in width in both sexes. The rapidity of growth ceased in the doe after 1 year, though some development still went on. The bucks tended to continue growing longer. Growth in the length of the bones of the hind legs was found to be more rapid but to end earlier than growth in the length of the front legs.

**Feeding potatoes to pigs,** D. R. EDWARDS-KER and I. J. HANNAFORD (*Scale-Hayne Agr. Col. Pamphlet* 9 (1923), pp. 7).—In a comparative feeding test lasting from January 26 to March 9, 6 pens of 4 pigs each were compared as to the gains made on a basal ration of 2 lbs. of sharps and 3 lbs. of barley meal and on rations in which 12 lbs. of raw or 8 lbs. of cooked potatoes replaced the barley. Lots receiving each of these rations were fed indoors as well as in the open.

The increases per pen made on the basal ration indoors were 110.75 lbs. and outdoors 112.25 lbs. When raw potatoes replaced the barley the indoor lot



gained 48.75 lbs. and the outdoor lot 65 lbs., but when cooked potatoes replaced the barley the indoor lot gained 120.75 lbs. and the outdoor lot 104.25 lbs. The results of the test showed that raw potatoes were unsatisfactory, but cooked potatoes made a good substitute for the barley.

**"Practice with science" in pig feeding**, C. CROWTHER (*Jour. Bath and West and South. Counties Soc.*, 5. ser., 17 (1922-23), pp. 57-70).—A discussion of the fundamental principles of pig feeding based on the results of scientific investigations.

**Breeding, growing, and finishing the bacon hog**, W. TOOLE and R. G. KNOX (*Ontario Dept. Agr. Bul.* 299 (1923), pp. 10, figs. 6).—This is a popular discussion of the principles of bacon hog raising.

**Protein poor, but carbohydrate rich, feed for heavy draft horses**, M. ASAM (*Jour. Landw.*, 71 (1923), No. 1, pp. 16-50, pl. 1).—This is a study from the Frederick Wilhelm University at Breslau of the possible substitution of beets for a part of the oats in the rations of heavy draft horses doing different amounts of work. One team of geldings and one team of mares were selected for the investigation. The rations were designated as the beet ration (fed to the geldings) consisting of 5 kg. of chopped rye straw, 3.5 kg. of hay, 3.5 kg. of pea straw, 2.5 kg. of ground oats, and 24 kg. of beets, and the oat ration 6 kg. of chopped rye straw, 3.5 kg. of hay, 3.5 kg. of pea straw, and 7.2 kg. of ground oats. The feeds were somewhat modified during the test, which lasted from January 6 to April 3, but it was planned to feed the same amount of starch equivalent to both teams throughout. The result showed, however, that considerably more starch equivalent was supplied by the oat ration than by the beet ration.

The amount of work varied. From January 6 to January 22 it was classified as medium, and during this time both teams practically maintained weight. From January 23 to March 3 the work was light and the horses gained weight, but from March 4 to April 3 heavy work was performed and the horses all lost in weight. The changes in weight were practically the same on both rations during the first period, but the gains were somewhat greater in the second period and the losses a little less in the third period on the oat ration.

During the entire test the team receiving the best ration lost 11.5 kg., whereas the other team gained 44.5 kg. Data on the distance the two teams had traveled during the test showed that the team receiving the best ration had traveled 28.87 per cent further than the other team. A comparison of the food consumption of these horses with the amount recommended by O. Kellner for medium, heavy, and light work indicates that his protein requirements are at least 25 per cent too high and his energy requirements 20 per cent too high. The use of beets to replace part of the oats in the rations of draft horses is recommended, especially when they are doing light or medium work. The economic saving which might thus result, if such a substitution were uniformly carried out, is estimated.

**The story of the horse**, W. H. CARTER (*Natl. Geogr., Mag.*, 44 (1923), No. 5, pp. 455-566, figs. 86).—This is a popular description of the history, development, and uses of horses in the different parts of the world, with many illustrations. Twenty-four colored paintings by E. H. Miner, showing the different types and breeds of horses, are reproduced, accompanied by descriptions of each type.

**The influence of the war on German horse breeding**, E. VON SCHICKFUS (*Landw. Jahrb.*, 56 (1921), No. 4, pp. 491-559, fig. 1).—This is an economic study of the changes which have occurred in the numbers and values of horses during the war in Germany. The effect of breeding organizations and the assistance offered by the provinces are discussed in detail. The value of horses was



shown to increase practically at the same rate as the value of the currency decreased.

**Poultry craft**, W. HOOLEY (*London: Poultry Press, Ltd., pp. XIX+473, pls. 23, figs. 83*).—This book consists of descriptions of the breeds of fowls; methods of housing, feeding, and breeding poultry; and the preparation of poultry for the table. The anatomy, physiology, and more common diseases of poultry are also discussed.

**The standardization of poultry experiments**, H. C. KNANDEL (*Poultry Sci., 2 (1923), No. 6, pp. 173-180*).—This is an appeal for the use of mathematical formulas in interpreting the significance of the results of experimental work. The error of the interpretation given to the results of a number of experiments already published is noted.

**The endogenous metabolism of hens and capons**, C. W. ACKERSON, M. J. BLISH, and F. E. MUSSEHL (*Poultry Sci., 2 (1923), No. 6, pp. 189-198, figs. 2*).—The results are given of experiments at the Nebraska Experiment Station to determine the endogenous nitrogen elimination of 5 White Rock and 2 Rhode Island Red hens, 7 Single Comb White Leghorn and 2 Buff Orpington pullets, and 7 Rhode Island Red and 8 Barred Rock capons. The experiments, which were repeated with some of the birds at different ages, lasted 6 days each, during which time the subjects were placed in a metabolism cage and received a ration of sugar, moistened paper pulp, gravel, and a salt mixture.

The average weights obtained from daily weights, ages, and elimination of nitrogen per bird and per kilogram of live weight are given in tabular form. The average nitrogen elimination per kilogram of live weight in 10 trials with White Rock hens was 114.7 mg. and in 6 trials with Rhode Island Red hens 130 mg. The average nitrogen elimination of immature birds seemed to decrease with age. The average nitrogen elimination of Single Comb White Leghorns was 276 mg. at 4.5 months of age and 174 mg. at 9 months of age. The average nitrogen elimination of the capons at 6, 7, 8, 10, and 12 months of age was 325, 286, 216, 147, and 116 mg., respectively, per kilogram of live weight.

The experiments brought out interesting information in regard to the ability of hens to lay on a nitrogen-free ration, as 1 Rhode Island Red hen laid eggs 122 hours after being placed on the nitrogen-free diet.

**Leg weakness in chicks**, W. T. JOHNSON (*Western Washington Sta. Bimo. Bul., 11 (1924), No. 5, pp. 103-105, fig. 1*).—The author attributes the main cause of leg weakness in chicks to lack of the fat-soluble vitamin, and suggests various sources of this vitamin for chick feeding.

**A pest which may prove to be a blessing**, M. FRIEDE (*Poultry Sci., 2 (1923), No. 6, pp. 181-188*).—The results of feeding experiments in Russia have shown that the pupae of the large red ant (*Formica rufa*) make an excellent feed for poultry. In the fresh condition they act as a stimulant to growth in young birds and as a stimulant to egg production in mature fowls. The use of the pupae is recommended in connection with a grain ration, except in the case of very young chicks, where they may be used in place of boiled hen's eggs. When the pupae are dried they still make a good food, but do not exhibit the stimulating action which seems so pronounced in the fresh material.

Experiments demonstrated that formic acid acted as a stimulant to the appetite and reproduction, and since the pupae contain formic acid their stimulating action to egg production and growth in the fresh state is attributed to their formic acid content. The pupae of *F. pratensis* also gave good results in feeding, but digestive disorders occurred when pupae of *Lasius flavus* were fed, especially to young birds.



**Changes in egg production in the station flock**, H. D. GOODALE (*Massachusetts Sta. Bul.* 211, pop. ed. (1922), pp. 3-7, pl. 1).—This is a popular edition of Bulletin 211, previously noted (E. S. R., 48, p. 574).

**The variation of eggs in the rate at which they lose weight.**—III, **The physical basis of variation in loss of weight**, L. C. DUNN (*Poultry Sci.*, 2 (1923), No. 6, pp. 199-204).—In continuing the study of the rate at which eggs lose weight (E. S. R., 50, p. 374), an investigation of the characteristics of the eggs of 6 hens in which the shell pores could be readily identified with the naked eye has been made. During 20 days' storage these eggs lost up to an average of twice as much weight as normal eggs. Twenty-six such eggs laid in June and August were divided into two lots according to those losing from 2.86 to 4.28 per cent of their weight and those losing from 1.3 to 2.83 per cent of their weight during 20 days' storage. The group with the greater weight losses averaged  $64.65 \pm 0.92$  gm. in weight, of which the shell made up to  $8.210 \pm 0.142$  per cent, as compared with an average egg weight of  $55.51 \text{ gm.} \pm 0.92$  for the group with the lower evaporation rate, of which the shell made up  $9.556 \pm 0.116$  per cent. The CaO content of the shells were very similar in both groups, except that it was uniformly lower for the August eggs than for the June eggs. The author concludes that these differences are not significant in influencing the loss of weight on storage, but that the extra loss is probably due to the porosity of the shells or to the lack of a deposit of the mucin on the surface of the shell which gives the egg its polished appearance.

**Correlation of sexual maturity to annual egg record**, F. A. HAYS and J. S. BENNETT (*Poultry Sci.*, 2 (1923), No. 6, pp. 205, 206).—The egg records of 1,450 birds hatched at the Massachusetts Experiment Station have been correlated with their age at first laying, and the following constants were calculated: Mean production  $147.3173 \pm 0.7321$  eggs, standard deviation of production  $44.0922 \pm 0.5177$  eggs, mean age  $228.8276 \pm 0.7677$  days, standard deviation of age  $46.2325 \pm 0.5428$  days, and coefficient of correlation of age at first egg to annual production  $-0.4380 \pm 0.0134$ . The importance of early sexual maturity when selecting for high-egg production is thus emphasized.

**The rate of senescence of the domestic fowl as measured by the decline in egg production with age**, S. BRODY, E. W. HENDERSON, and H. L. KEMPSTER (*Jour. Gen. Physiol.*, 6 (1923), No. 1, pp. 41-45, figs. 1).—In studying the relation of the egg production in fowls to the stage of senescence at the Missouri Experiment Station the records of hens to 8 years of age are given, and it is shown that the yearly decline is exponential, each year's production being about 88 per cent of that for the preceding year. Calculating the total life production of the average of these fowls showed that they should produce 1,369 eggs. Since M. R. Curtis found an average of 1,814 oocytes visible to the naked eye in the ovaries of 13 hens, as reported by Pearl (E. S. R., 28, p. 576), the authors conclude that the number of oocytes is not the limiting factor in egg production and suggest that "this exponential law of egg production substantiates the idea that senescence is a physico-chemical process, the course of which is limited by a chemical reaction."

## DAIRY FARMING—DAIRYING.

**Dairy cattle and milk production**, C. H. ECKLES (*New York and London: Macmillan Co.*, 1923, rev. ed., pp. XX+591, figs. 98).—This is a revised and much enlarged edition of the book previously noted (E. S. R., 26, p. 78). The newer portions of the book deal especially with calf raising and the factors affecting growth, the business side of the purebred business, and silos and



silage as a feed. A new chapter prepared by M. H. Fohrman on cattle breeding is also included.

**Selection and value of the dairy cow,** L. ROY (*Choix et Appréciation de la Vache Laitière. Paris: Libr. Agr. Maison Rustique, 1923, pp. 76*).—This is a popular presentation of the principles of judging dairy cattle.

**The rate of growth of the dairy cow.**—III, IV, S. BRODY, A. C. RAGSDALE, and C. W. TURNER (*Jour. Gen. Physiol.*, 6 (1923), No. 1, pp. 21-40, figs. 6).—This continues this series (E. S. R., 49, p. 374).

III. *The relation between growth in weight and increase of milk secretion with age.*—The authors show that the increase in butterfat production of cows from 2 to 9 years of age follows the course of a monomolecular chemical reaction of a velocity similar to that for body weight.

To estimate the dependence of increased fat production on weight, official and semiofficial records of the various breeds of dairy cattle were classified into convenient age groups. The curves for the relation of weight to production were found to be independent for each age and were not connected. An increase of 100 lbs. in the weight of a constant age group was accompanied by an increase of about 20 lbs. in yearly fat production, whereas an increase of 100 lbs. in the weight of the cows of all ages was accompanied by increases of over 100 lbs. in yearly fat production. These results thus indicate that the increases in fat production and body weight are largely independent of each other, though they follow a similar course. The authors state that this fact adds further proof to the theory that growth is limited by a chemical reaction.

IV. *Growth and senescence as measured by the rise and fall of milk secretion with age.*—A study of 45,984 yearly and 10-month fat records of purebred dairy cows and 104,560 7-day Holstein records indicates that fat production not only increases with age to 8 years according to the course of the curve of a monomolecular chemical reaction, but that after this age the production also declines exponentially. It is therefore suggested that the course of fat secretion with age follows two simultaneous consecutive molecular reactions. The decline in fat production was taken as a measure of the stage of senescence, and it is thus indicated that senescence is also controlled by a chemical reaction.

**A system of rearing dairy calves with limited use of milk,** L. A. MAYNARD and L. C. NORRIS (*Jour. Dairy Sci.*, 6 (1923), No. 5, pp. 483-499, figs. 5).—The growth curves are presented of 7 grade and 6 purebred Holstein and 2 purebred Shorthorn calves, raised to 6 months of age without milk after they were from 4 to 8 weeks old, in two experiments at the New York Cornell Experiment Station. The curves were compared with the growth curves of Eckles for dairy calves (E. S. R., 43, p. 876). The calves received whole milk until about 4 weeks of age, when a gradual change was made to a gruel consisting of 5 parts of water and 1 part of a mixture consisting of 25 lbs. of corn meal, 25 lbs. of red dog flour, 15 lbs. of ground oat groats, 15 lbs. of linseed oil meal, 10 lbs. of ground malted barley, 10 lbs. of soluble blood flour, 1 lb. of precipitated calcium carbonate, 1 lb. of precipitated bone meal, and 1 lb. of salt.

As soon as the calves would eat they had access to alfalfa or clover hay and a dry grain mixture of 3 parts each of hominy, ground oats, and wheat bran and 1 part of oil meal. In the second experiment carrots chopped and boiled for 5 minutes were added to the milk gruel mixture when the change was being made from milk to gruel. The amount of carrots varied from 0.1 lb. per day at first to 0.5 lb. at the time the milk was discontinued. Raw carrots were then fed with the grain up to 1 lb. per day.

To determine the rates of growth the calves were weighed weekly, and in the second experiment monthly measurements of the height at withers



were also made. The 7 grade Holstein heifer calves used in the first experiment made average daily gains of 1.44 lbs., which is the same as the gains made by Eckles' calves. The growth curves show that at least 5 of the 7 calves used suffered temporary checks in growth when the change from milk to gruel was made. The authors suggest that the hot weather and the use of each calf for a few days in a metabolism cage may have been somewhat disadvantageous to growth.

In the second experiment 6 purebred Holstein and 2 purebred Shorthorn calves were used. The Holsteins made average daily gains in weight of 1.7 lbs., and the growth curves of all the calves equaled those of the curves suggested by Eckles both in weight and height at withers, and in 4 cases they markedly exceeded Eckles' curves. No retardations in growth occurred at the time of stopping the milk. Like results were obtained with the Shorthorns. The authors attribute the better growth in the second test to more advantageous weather conditions and the addition of carrots to the ration.

Six purebred Holstein heifer calves reared on skim milk in the university herd at practically the same time as experiment 2 was in progress made average daily gains in weight to 6 months of age of 1.71 lbs.

**Studies in the growth and nutrition of dairy calves.**—VII, The use of the self-feeder with young dairy calves, A. C. McCANDLISH (*Jour. Dairy Sci.*, 6 (1923), No. 5, pp. 500-508).—In continuing the study of nutrition of dairy calves (E. S. R., 50, p. 275), the results of experiments are reported in which 1 Guernsey bull calf 70 days of age and 1 Holstein heifer and 1 Ayrshire heifer 30 and 37 days of age, respectively, were given access for two 30-day periods to a self-feeder containing a number of feeds in separate compartments. In addition the calves were fed whole and skim milk as seemed necessary, and furnished with water.

During the first and second test periods, respectively, the 3 calves consumed the following total amounts of the different feeds: 864 and 678 lbs. of whole milk, 168 and 678 lbs. of skim milk, 1.3 and 108.6 lbs. of shelled corn, 58.7 and 68.4 lbs. of whole oats, 0.4 and 0.5 lb. of ground oats, 15.3 and 1.9 lbs. of gluten feed, 13.3 and 17.3 lbs. of wheat bran, 62.7 and 75.6 lbs. of linseed oil meal, 32.7 and 91.9 lbs. of alfalfa hay, 1.1 and 0.3 lbs. of salt, 0.7 and 1.3 lbs. of charcoal, and 384 and 689 lbs. of water, and in the second period 0.3 lb. of cracked corn and 0.3 lb. of hominy feed were also consumed. In their grain consumption the calves showed a distinct preference for the whole grains as compared with the ground grains and for linseed meal as compared with the other high protein feeds.

The nutritive ratio of the ration consumed was 1:3.4 in period 1 and 1:3.5 in period 2, which is narrower than would usually be recommended, but the calves made good gains, averaging 1.98 lbs. per day for the two periods. The author states that the calves on self-feeders remained in a good growthy condition, but did not get too fat.

**The comparative values of protein, fat, and carbohydrate for the production of milk fat,** E. J. SHEEHY (*Roy. Dublin Soc. Sci. Proc., n. ser.*, 17 (1923), No. 20-24, pp. 211-218, figs. 3).—To compare the relative values of protein, carbohydrates, and fats for butterfat production, 3 goats receiving a basal ration of 1 lb. of hay, 10 lbs. of mangels, 0.5 lb. of crushed oats, and 0.5 lb. of white fish meal per day were given individually, in addition, during different periods from 1.25 to 2.25 lbs. of cornstarch, 1.25 lbs. of casein, or from 0.25 to 1 lb. of hydrogenated soy bean oil. These supplements were interchanged during the test, which lasted from May to December, 1922.

Graphs prepared show the effect on the milk production, fat percentage, and body weight of feeding each supplement to each animal. The results indicated



that, when the minimum amounts of food constituents were present, additional amounts of protein or starch were of approximately equal value, whereas fat was 2.25 times as valuable as starch or protein for butterfat production. The addition of fat to a ration containing less than the minimum fat required had a much greater comparative value.

**The variations of milk yield with cow's age and the length of the lactation period,** J. WILSON (*Roy. Dublin Soc. Sci. Proc., n. ser., 17 (1922), No. 11-12, pp. 97-104, figs. 2*).—This consists of a study of the effect of age and length of lactation period on milk production, based on the records of Ayrshire cows in Scotland as reported by the Ayrshire cattle milk records committee for 1913, 1919, and 1920, with discussions and comparisons with the work of Gavin (*E. S. R., 30, p. 572*) and Pearl and Miner (*E. S. R., 42, p. 69*).

**Notes on the pasteurization of milk,** J. M. HAMIL (*Gt. Brit., Min. Health, Rpts. Pub. Health and Med. Subjs. No. 17 (1923), pp. 14*).—This is a general discussion of pasteurization of milk from the standpoint of its effect upon the bacterial content and the chemical and physical properties of the milk. Descriptions of various types of commercial pasteurizers are included.

**Abnormal fermentations in milk with special reference to ropy milk,** A. E. PERKINS (*Ohio Sta. Mo. Bul., 8 (1923), No. 11-12, pp. 187-190*).—Calcium hypochlorite is recommended as a disinfectant for cleaning dairies and dairy utensils in order to prevent outbreaks of abnormal fermentations, such as ropy milk.

**Ice cream ingredients,** H. P. DAVIS, B. MASUROVSKY, and J. A. LUTHLY (*Nebraska Sta. Circ. 22 (1924), pp. 3-22*).—This is a discussion of the composition and function of each ingredient in the ice cream mix, with reference to the amounts which should be used to produce ice cream of the best quality and conforming to Federal and State standards, which are summarized in the appendix.

**How acidity affects the quality of the mix,** W. B. COMBS and W. H. MARTIN (*Ice Cream Trade Jour., 19 (1923), No. 11, pp. 75, 76, figs. 3*).—Two experiments to determine the effect of the acidity of the mix on the standing-up qualities of ice cream were carried on at the Pennsylvania Experiment Station. The mixes in each case contained approximately 15 per cent of fat, 14 per cent of sugar, and 0.5 per cent of gelatin. On leaving the samples of frozen ice cream on a wire gauze at room temperature it was found in the first experiment that the sample containing 0.43 per cent acidity melted down most rapidly, followed in order by samples containing 0.247 and 0.385 per cent acidity. A sample containing 0.35 per cent retained its shape for over 2.5 hours. In the second experiment, samples containing 0.4143 and 0.431 per cent acidity melted down rather uniformly, while samples containing 0.467 and 0.477 per cent tended to retain their shape longer. The authors explain these differences as due to a greater retention of water by the colloidal substances in the slightly acid medium, but when the medium becomes too acid the amount of water retained will decrease.

**The influence of manufacturing operations on the bacterial content of ice cream,** F. W. FABIAN and R. H. CROMLEY (*Michigan Sta. Tech. Bul. 60 (1923), pp. 5-24, fig. 1*).—The effect of different operations in ice cream manufacturing on the bacterial content of the finished product was studied by making plate counts on A. P. H. A. agar incubated at 37° C. of samples of 48 mixes of vanilla ice cream before and after pasteurization, homogenization, cooling, aging, freezing, and hardening. The bacteriological content of the cream, condensed milk, and gelatin used in making the ice cream indicated that these substances may be sources of bacterial contamination. The percentage of samples of ice cream showing no change, increases, and decreases in their



bacterial counts during the different operations are summarized in the table below, as well as the maximum, minimum, and average changes in bacterial counts which have occurred during each operation.

Changes in bacterial counts of ice cream mixes during the different operations in manufacture.

Operation.	Sam- ples show- ing no change.	Increases in bacterial count.				Decreases in bacterial count.			
		Sam- ples.	Change in bacterial count.			Sam- ples.	Changes in bacterial count.		
			Mini- mum.	Maxi- mum.	Aver- age.		Mini- mum.	Maxi- mum.	Aver- age.
	Per ct.	Per ct.	Per ct.			Per ct.	Per ct.		
Pasteurization.....						100.00	94.50	99.90	98.97
Homogenization.....	15.20	74.00	5.90	1,400	154.80	10.8	9.09	86.19	34.21
Cooling.....	21.75	52.17	3.17	400	51.45	26.08	4.76	100.00	27.29
Aging.....	10.52	47.36	4.35	409	103.00	42.10	4.54	81.81	26.98
Freezing.....	17.07	46.34	.95	260	46.47	36.58	3.85	59.68	25.95
Storage (1 day).....	8.33	25.00	2.94	125	48.81	66.67	9.09	72.22	41.89
Storage (1 week).....	14.29					85.71	9.09	33.33	23.90

The authors suggest that the general effect of the different operations is really to increase the bacterial content except in the case of pasteurization. They also suggest that the increase during homogenization may be apparent rather than actual, due to a breaking up of the colonies.

**Ice cream investigations** (*New York State Sta. Rpt. 1923, pp. 37, 38*).—In addition to the results of the study of the cause of the greenish black color in chocolate ice cream previously noted (*E. S. R., 50 p. 477*), the relation of the air cells and water crystals to smoothness has been studied microscopically. Small uniform air cells which withstand the pressure of hardening favor smoothness. Gelatin and homogenization aid the air cells in retaining their size and shape, but butterfat has little effect, though it prevents ice crystals from growing in size.

**Statistics relative to the dairy industry in New York State, 1922, together with report on transportation of milk** (*N. Y. State Dept. Farms and Markets, Agr. Bul. 158 (1923), pp. 125, pl. 1, figs. 20*).—The first part of this work deals with the dairy statistics of New York State relative to the number and size of farms, number of cows, amount of milk produced, and the disposal of dairy products by the milk plants. The second part deals with the rates and methods of transporting milk and other dairy products within the State.

**Dairy statistics in Switzerland for the year 1922**, A. PETER ET AL. (*Ann. Agr. Suisse, 24 (1923), No. 1, pp. 33-49*).—This is the report of an economic study of dairying in Switzerland made by a special committee of the Swiss dairy commission. The quantity and value of milk produced during 1920, 1921, and 1922, the way it was used, and the exports and imports of dairy products are especially discussed.

VETERINARY MEDICINE.

**Infection and resistance**, H. ZINSSER (*New York: Macmillan Co., 1923, 3. ed., rev., pp. XVI+666, figs. 45*).—In this revision of the volume previously noted (*E. S. R., 39, p. 679*), a number of changes have been made in the arrangement of material, the chapters on anaphylaxis have been completely

rewritten, and the chapters on practical therapeutics have been enlarged and rewritten. The final chapter on colloids of the previous edition has been omitted because of the many books now available on the subject.

**The basic principles for prevention and control of infectious diseases among livestock**, B. H. EDGINGTON (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 11-12, pp. 169-172).—In this account the author calls attention to the manner in which infectious diseases of livestock may be controlled, namely, (1) by destroying disease-producing germs or virus, (2) by protecting susceptible animals, and (3) by eliminating avenues for spreading infection.

**Diseases of small domestic animals and their treatment**, A. DASSY (*Les Maladies des Petits Animaux Domestiques et Leur Traitement. Paris: Libr. Inst. Natl. Agron.*, 1923, pp. 97).—This is a brief summary of information on the diseases of small domestic animals and of bees and silkworms.

**The Animal Contagious Diseases Act and the regulations made thereunder relating to quarantine and the control of disease** (*Ottawa: Canada Dept. Agr., Health of Anim. Branch*, 1922, pp. 71).—The text of the acts and regulations promulgated relating to quarantine and the control of diseases of livestock in Canada are brought together.

**Annual report of proceedings under the diseases of animals acts for the year 1922** ([*Gt. Brit.*] *Min. Agr. and Fisheries, Ann. Rpt. Proc. Diseases Anim. Acts*, 1922, pp. 106, pls. 2).—This report of the chief veterinary officer deals with the occurrence of infectious diseases of livestock, including foot-and-mouth disease (pp. 3-34), rabies, hog cholera, sheep scab, anthrax, glanders, parasitic mange of horses, and epizootic abortion in cattle, particularly the first mentioned. The details of cases of foot-and-mouth disease in 1922, in which isolation of affected animals was adopted; an outline of general restrictions imposed in connection with the outbreaks of the disease; a summary of orders imposing and modifying restrictions; orders of the ministry relating to the prevention of its introduction into Great Britain; and other data are appended.

**The veterinary service and meat inspection in Norway, 1921** ([*Dir. [Norway] Civ. Veterinaerves.*], *Veterinaerves. og Kjøttkontrol.*, 1921, pp. VIII+200, figs. 9).—This annual report presents data, largely statistical, on the occurrence of diseases of animals and meat inspection work in Norway.

**On the effects of cold on the vitality of certain cysticerci and echinococci in meat kept under commercial conditions of freezing in Johannesburg**, A. PORTER (*So. African Inst. Med. Research. Pubs.*, No. 16 (1923), pp. 49).—"The present investigation has dealt with the effect of continued cold on the viability of the cysticerci of *Taenia solium*, *T. saginata*, and *T. crassicolis*, and on the echinococcus, of *T. echinococcus*, the flesh of infected hosts being frozen under the commercial conditions possible at an abattoir such as that at Johannesburg.

"Tests for viability of the various larval forms of the aforementioned tapeworms were based on the morphology, motility, and staining reactions of the cysticerci or echinococci, and on their power to develop into adult tapeworms in experimental animals (dogs and kittens) in the cases of *T. crassicolis* and *T. echinococcus*. Animal experiments with *T. solium* and *T. saginata* failed, as has been the experience of other workers, and these adult tapeworms seem to be specific to man. Staining reactions proved to be the most satisfactory means of testing the viability of *Cysticercus bovis* and *C. cellulosae*. Methyl green slightly acidulated with acetic acid was the most satisfactory stain of those used. Dead cysticerci stain relatively deeply and rapidly compared with control living cysticerci from freshly killed beef or pork. Deep-seated cysticerci should be used for staining tests.



"Cysticerci and echinococci frozen for short periods have retained their vitality as judged by staining reactions. The administration of meat containing hydatids of *T. echinococcus* frozen for 30, 43, 61, and 70 days to clean laboratory-bred dogs has resulted in infection with *T. echinococcus*. Similarly, freezing for a month was found experimentally not to have destroyed the vitality of *C. fasciolaris*, as adult *T. crassicollis* were obtained in clean laboratory animals after feeding on the frozen cysticerci. By analogy, freezing for short periods is not likely to kill *C. bovis* or *C. cellulosae*, and this is confirmed from consideration of the staining reactions and morphological condition of these cysticerci under similar conditions of experiment. Deep-seated cysticerci remain alive after freezing when surface ones are killed, as judged by staining reactions and morphology. Cysticerci protected by fat are still living when unprotected ones have been killed by freezing. Motility tests for viability were found undependable and unsatisfactory. Physical degeneration in any form, lack of motility under the influence of warmth, and rapid taking up of stains, as a total picture, are probably indicative of the dead condition of the bladder worms under investigation.

"Freezing at temperatures ranging from  $-5$  to  $-18^{\circ}$  C. for a period of about 10 weeks appears to destroy the vitality of all the cysticerci in carcasses of beef and pork. For safety, a margin should be allowed on this period of freezing, and it is suggested that a period of at least 12 weeks' freezing of slightly infested beef or pork at a temperature of  $14^{\circ}$  F., that is,  $-10^{\circ}$  C., should be undergone before the meat may be regarded as sterile and the cysticerci as dead. In regard to the suitability of frozen measly meat for human consumption, the experimental evidence goes to show that if such meat be frozen for 12 weeks the contained cysticerci are unlikely to develop into tapeworms in the human digestive tract. Nevertheless, the nutritive value of the meat and its keeping properties are less satisfactory than those of normal frozen meat. Where heavy infestation of a carcass occurs, in my opinion, such a carcass should not be used for human food, even if frozen for 12 weeks. Where the bulk of the parasites is large, meat so infested can not be considered either wholesome or nourishing. Total loss to the owners can be avoided by the consignment of such carcasses to the inedible-tallow works or the fertilizer plant, as is done in South America.

"Meat very slightly measled, so that the cysticerci detectable could be removed and the remainder issued almost certainly as normal, might profitably be frozen for 12 weeks and then be issued for human consumption, preferably under declaration of its nature, instead of being condemned. The Freibank system of utilization of Germany and that used in Argentina are noted. "In the absence of such a system, it is obvious that more care is necessary in dealing with meat infested with measles, and much longer periods of freezing are necessary than have been used previously to insure the death of the bladder worms."

**New method for increasing yield of therapeutic and diagnostic serum.** J. FREUND (*Jour. Infect. Diseases*, 33 (1923), No. 4, pp. 328-330).—The method described involves, first, the separation of the hemoglobin from the plasma before clotting, either by the addition of sodium citrate or oxalate to the freshly drawn blood, or by cooling the blood and maintaining it at a low temperature. The clotted plasma is then subjected to sufficient pressure to separate the fibrin from the serum. It is stated that by this method it has been found possible to obtain from 10 to 95 per cent greater yield of serum free from hemoglobin than in the ordinary method of allowing the blood to clot and withdrawing the serum during contraction of the clot. The variation in the yield is thought to depend on whether the animal has been bled before or



not, the greatest difference between the two methods being in the case of the animals which have been bled but once.

**The blood test for contagious abortion**, J. W. KALKUS (*Western Washington Sta. Bimo. Bul.*, 11 (1924), No. 5, pp. 90-92).—The nature and value of the agglutination test in the diagnosis of contagious abortion are described, and it is announced that the author has made arrangements whereby a limited number of tests can be made for residents of this State at a nominal charge.

**The specific identity of *Bacillus paratuberculosis***, H. R. SEDDON (*Roy. Soc. Victoria Proc.*, n. ser., 35 (1923), No. 2, pp. 159-163).—Previously noted from another source (*E. S. R.*, 48, p. 678).

**Bayer 205 as a prophylactic for trypanosomiasis in the larger domesticated animals**, F. RUPPERT (*Berlin. Tierärztl. Wehnschr.*, 39 (1923), No. 32, pp. 369, 370; *abs. in Trop. Vet. Bul.*, 11 (1923), No. 4, pp. 116, 117).—Investigations have shown that in doses of 0.4 gm. per kilogram Bayer 205 protected rabbits against inoculation with *Trypanosoma equiperdum*, *T. equinum*, and *T. brucei* for periods up to six months, but that death from trypanosomiasis occurred when the period elapsing between the injection of the drug and inoculation was longer. In testing the toxicity of Bayer 205, in which 11 horses were used, the toxic dose was found to be 1 gm. per 100 lbs. body weight and the maximum dose tolerated to be 0.75 gm. This maximum dose, however, produced symptoms in two of three animals. A dose of 0.5 gm. was found to be sufficient for protection when the infective inoculation was made after an interval of a month, and experiments with 5 horses showed this amount to be also sufficient to effect a cure.

**The biological properties of the lipoids of the tubercle bacillus**, A. BOQUET and L. NÈGRE (*Ann. Inst. Pasteur*, 37 (1923), No. 9, pp. 787-805).—Essentially noted from another source (*E. S. R.*, 48, p. 280).

**Tubercle bacillus infection and tuberculosis in man and animals**, A. CALMETTE, trans. by W. B. SOPER and G. H. SMITH (*Baltimore: Williams & Wilkins Co.*, 1923, pp. XXIII+689, pls. 25, figs. 31).—This is the authorized English edition of the volume previously noted (*E. S. R.*, 48, p. 777).

**The reaction of complement deviation applied to the diagnosis of bovine tuberculosis**, BROcq-ROUSSEU, A. URBAIN, and CAUCHEMEZ (*Ann. Inst. Pasteur*, 37 (1923), No. 9, pp. 872-878).—An extension of the application of the complement fixation test for bovine tuberculosis (*E. S. R.*, 48, p. 483), is reported.

Of 203 serums of cattle found on autopsy to be tuberculosis, 94.09 per cent reacted positively, while of 74 from animals showing no lesions on autopsy all but 1 reacted negatively.

**Studies in complement fixation in bovine tuberculosis**, J. A. KOLMER and F. BOERNER, JR. (*Jour. Amer. Vet. Med. Assoc.*, 63 (1923), No. 4, pp. 423-444, fig. 1).—The studies reported in this paper were undertaken as a part of an extensive series of investigations by the senior author on the general subject of complement fixation in bacterial infections, the special purpose being to determine the application to the testing of bovine tuberculosis of the author's new complement fixation method for syphilis, an antigen of tubercle bacilli replacing the lipoidal extracts employed in the syphilis test. The work is reported in three parts as follows:

I. *The influence of heating sera and the kind and duration of primary incubation upon the occurrence of specific and nonspecific tuberculosis complement fixation tests with cattle sera.*—This deals especially with the nature and mechanism of the positive reaction sometimes occurring with the sera of apparently healthy tuberculin-negative cattle showing no lesions of tuberculosis on post-mortem examination. The technique of the test is described, and data



are reported on the effect of heating the sera and of the method of primary incubation upon the test.

Sera from cattle, calves, sheep, and horses which were clinically free of tuberculosis were tested after heating for 15 and 30 minutes at 55° C. and for 30 minutes at 60°. The percentage of positive reactions was highest in all cases in the sera heated at 55° for 30 minutes, showing that under such conditions certain nonspecific reactions occur and that to avoid such reactions a temperature of at least 60° for 30 minutes should be used.

In determining the best procedure for the primary incubation of the sera 1 hour in a water bath at 38°, 2 hours in a water bath at 38°, and 18 hours in a refrigerator at 8° were used with the following results: "A primary incubation of 18 hours at 8° increases the amount of complement destruction, the amount of complement fixed by antigen alone and serum alone, as well as the amount specifically fixed by mixtures of serum and antigen. The method of cold primary incubation of 18 hours at 8° is probably preferable to a water bath incubation of 1 hour at 38°, but requires the use of smaller amounts of serum for avoiding nonspecific reactions."

II. *The occurrence of specific tuberculosis complement fixing substances in the sera of tuberculin-negative cattle.*—In addition to the nonspecific reactions occurring with negative sera, as noted above, it has been found that the sera of from 6 to 15 per cent of tuberculin-negative cattle may show weakly positive but specific tuberculosis complement fixation tests. The substances responsible for these reactions can be removed in whole or part by prolonged absorption of the sera with washed tubercle bacilli, thus indicating that they are of specific amboceptor nature.

"It is possible that these tuberculosis amboceptors are present in the sera of cattle as natural amboceptors, or they are produced as the result of injections, or possibly but not probably, they are produced by small, undetectable foci of latent tuberculosis. The occurrence of these 'normal' but specific reactions very much reduces the practical application of the complement fixation test in the diagnosis of tuberculosis in cattle."

III. *The diagnostic value of the complement fixation test in bovine tuberculosis.*—In a further application of the complement fixation test to 162 sera of clinically nontuberculous and tuberculin-negative cattle, 29 sera of tuberculin-positive cattle (no necropsies), and 39 sera of tuberculous cattle (necropsies), the sera were heated at 60° for 30 minutes and employed in doses of 0.1, 0.05, and 0.025 cc., with a primary incubation period of 1 hour at 38° or 18 hours at 8°. The results are considered more reliable, i. e., involving fewer nonspecific reactions in doses of 0.05 cc. at the higher temperature and 0.025 cc. at the lower. Under these conditions the following percentages of positive reactions were obtained: For the clinically nontuberculous cattle 6 and 15 per cent, for the tuberculin-positive cattle 15 and 25, and for the tuberculous cattle 50 and 72 per cent, respectively. The authors conclude that the chances for error are too great and the percentage of true specific reactions too small for the complement fixation reaction to be a practical diagnostic test for tuberculosis of cattle.

**Cancer of the ear of sheep**, S. DODD (*Jour. Compar. Path. and Ther.*, 36 (1923), No. 4, pp. 231-242, figs. 3).—This is a contribution to the knowledge of chronic irritation as a factor in the causation of cancer in the lower animals.

**Contagious pustulous stomatitis of sheep (mutton chancre)**, M. AYNARD (*Ann. Inst. Pasteur*, 37 (1923), No. 5, pp. 498-527, pl. 1, figs. 2).—This is a further discussion of this disease (*E. S. R.*, 46, p. 484) from the standpoint of symptoms, experimental production, properties of the virus, immunity, comparison with sheep pox, and vaccination.

**The kidney worm of hogs in New South Wales, *Sclerostomum renium*, n. sp.,** J. DRABBLE (*Jour. Compar. Path. and Ther.*, 36 (1923), No. 4, pp. 217-230, figs. 9).—This is a continuation of studies by the author, a preliminary account of which has been previously noted (E. S. R., 48, p. 679). Under the name *S. renium*, the author describes a new species found to occur in New South Wales which is specifically distinct from *S. dentatus*.

**A case of black tongue, with post-mortem findings,** J. GOLDBERGER, W. F. TANNER, and E. B. SAYE (*Vet. Med.*, 19 (1924), No. 2, pp. 133-135).—Previously noted from another source (E. S. R., 50, p. 284).

**The control of chicken pox and roup,** J. W. FULLER (*North Amer. Vet.*, 5 (1924), No. 1, pp. 24, 25).—A brief discussion is given of the various methods which have been used in chicken-pox vaccination, together with a description of the method previously employed by the author (E. S. R., 49, p. 183) and further data on its success. It is recommended that as a preventive measure one dose of 1 cc. be given each pullet going into laying quarters in the fall in localities in which chicken pox is known to exist, and that if chicken pox appears in a flock the entire flock be vaccinated with 1 cc. each and the worst cases removed and revaccinated every third or fifth day. In flocks in which both roup and chicken pox are present a mixture of the chicken pox and avian mixed bacterin is recommended, or one dose of chicken pox vaccine followed at 3- to 5-day intervals by one or two doses of avian mixed bacterin.

**Avian typhoid fever,** C. TRUCHE (*Ann. Inst. Pasteur*, 37 (1923), No. 5, pp. 478-497).—Essentially noted from another source (E. S. R., 50, p. 82).

**Paratyphoid of the fowl,** K. REITSMA (*Tijdschr. Vergelijk. Geneesk.*, 10 (1924), No. 1, pp. 6-33).—The author presents an account of a paratyphoid enzootic which took place among pigeons in Amsterdam. The enzootic was caused by *Bacillus paratyphosus* B, which seemed to be pathogenic to pigeons, ducks, poultry, rabbits, guinea pigs, mice, and rats. Pigeons are most susceptible, ducks less, and then poultry.

## RURAL ENGINEERING.

**The design of diagrams for engineering formulas and the theory of nomography,** L. I. HEWES and H. L. SEWARD (*New York and London: McGraw-Hill Book Co., Inc.*, 1923, pp. XIII-111, figs. 83).—This is a practical treatise on the principles of the design of diagrams for the solution of engineering and other formulas, the purpose being not merely to give elementary methods of drawing simple diagrams but also to develop the grasp of the reader so that he will be able to analyze the more complex formulas of engineering practice. It contains chapters on function scales, elementary diagrams, alignment diagrams or collinear nomograms, alignment diagrams for formulas in more than three variables, alignment diagrams with two or more indexes, and alignment diagrams with adjustment, and appendixes on determinants of the third order and the projective transformation.

**Proceedings of the thirty-fifth annual meeting, Iowa Engineering Society** (*Iowa Engin. Soc. Proc.*, 35 (1923), pp. 118, pls. 2, figs. 26).—At this meeting, held at Des Moines, Iowa, January 23-26, 1923, the following special reports, among other features, were presented: Rainfall and the Run-off from Some Iowa Drainage Districts, by W. J. Schlick; Drainage Assessments against Highways and Railroads, by W. H. Root; Highway Drainage, by J. L. Parsons; Iowa Highway Transportation Problems and Suggested Solution, by C. C. Coykendall; and Experiments on Nebraska Pit-run Gravels, by W. H. Campen.



**Hydraulic tests of flap valves on drainage pipe outlets**, F. A. NAGLER (*Engin. News-Rec.*, 91 (1923), No. 26, pp. 1052, 1053, figs. 3).—Experiments conducted at the University of Iowa to determine the angles of repose and loss of head in double hinged cast-iron flap gates in sizes 18, 24, and 30 in. in diameter are reported.

The loss in head through each gate was observed with outlet velocities of from 1 to 8 ft. per second, while the corrugated pipe to which the gate was attached flowed either partially or entirely full, and with the jet at the outlet discharging freely in the air or entirely submerged.

The angle which the shutter makes with the vertical was found to be practically the same for the various gates tested. The loss in head caused by any gate proved to be less than 0.01 ft. under all velocities of flow when the water discharged from the outlet freely into the air. The maximum loss in head from a submerged outlet for all three gates was reached when the velocities of flow were between 2 and 3 ft. per second, in which case the shutter hung at angles between 23 and 34° with the vertical. The loss of head reached a maximum of 0.116 ft. for the 30-in. gate.

Tests of the 30-in. gate for leakage, when held firmly against its seat by backwater in a testing flume, showed that the maximum leakage with heads varying from 1.6 to 4.5 ft. on the center of the gate was 0.015 ft. per second, the leakage decreasing with increase in head.

It is concluded that the loss of head through gates of this type is very small, and that such gates have but little effect upon the discharging capacity of drainage outlets. It is also concluded that if they are kept free from twigs and débris and properly installed, they may be depended upon to effectively stop the inflow of backwater.

**A note on well boring**, W. M. SCHUTTE (*Bombay Dept. Agr. Bul.* 111 (1923), pp. 32, figs. 14).—This is a general treatise on the subject of well boring and the apparatus therefor, presented in favor of the adoption of the process as a modern method of securing water supplies in the Bombay Presidency. Special attention is drawn to the securing of artesian supplies.

**Concrete roads and their construction** (London: Concrete Pubs., Ltd., 1923, 2. ed., pp. XVI+210, figs. 151).—This is a description of the concrete roads in the United Kingdom, together with a summary of the experience with this form of construction gained in Australia, Canada, New Zealand, and the United States. It contains chapters on concrete roads in industrial works and on private estates, the international road congress at Seville, mechanical devices for making concrete roads, concrete curbing, specifications for concrete roads, memoranda for concrete users, and the use of concrete for road accessories.

**Road laws of Kentucky** (Frankfort: Dept. State Roads and Highways, 1923, pp. 129).—The text of the laws is given.

**Southern yellow pine** (New Orleans, La.: Southern Pine Assoc., 1923, 9. ed., pp. 186+XII, pl. 1, figs. 51).—This is the ninth edition of this handbook (E. S. R., 42, p. 580) and contains additional data for use in technical design.

**Research on the physical properties of Australian woods**, J. E. BISHOP (*Aust. Forestry Jour.*, 6 (1923), No. 9, pp. 228-234, figs. 4).—This is an argument for comprehensive research on the physical properties of Australian timbers, in which a review is made of work already done and its inadequacy brought out.

**The destructive distillation of wood**, H. M. BUNBURY (London: Benn Bros., Ltd., 1923, pp. XX+320, figs. 108).—This publication describes plants, processes, and methods adopted in modern wood distillation practice, and gives an ac-



count in some detail of the physical and chemical properties of wood. It contains chapters on the rise and development of the wood distillation industry; varieties of wood employed; the physical properties of wood; the chemistry of wood; commercial products resulting from the thermal decomposition of wood; factors influencing the thermal decomposition of wood; the crude products of distillation; the thermal decomposition reactions; wood distillation on a commercial scale; the factory; wood distillation plant and operations—(1) the production of charcoal and crude pyroligneous acid, (2) the production of dilute calcium acetate solution and wood alcohol, (3) the production of dry calcium acetate, refined wood alcohol, pure methyl alcohol, refined wood turpentine, and pine oils, (4) the production of wood tar, wood oils, and wood pitch, and (5) the destructive distillation of small wood and wood waste; the production of illuminating and power gas from wood; analytical methods; and statistics.

**Economical internal-combustion engine fuels**, FERROUILLAT (*Compt. Rend. Acad. Agr. France*, 9 (1923), No. 32, pp. 817-822).—The results of actual tests of such internal-combustion engine fuels as alcohol, vegetable oils, and producer gas from charcoal are briefly reported and discussed.

[**Producer gas for internal-combustion engines**], A. TRONCHON (*Génie Rural*, 16 (1923), No. 134, pp. 3-6, figs. 2).—Experiments conducted in France on the use in internal-combustion engines of gas produced from wood and wood carbon, by destructive distillation are briefly presented, and the results are compared with similar results obtained with other fuels. The gas is produced by passing water vapor over glowing wood carbon or ignited wood. The best gas apparently is obtained from the wood carbon. Data on the actual use of producer gas in trucks and tractors are presented, showing an economy of somewhat over 35 per cent as compared with other internal-combustion fuels.

**The Ohio dynamometer**, G. W. MCCUEN (*Agr. Student*, 30 (1923), No. 3, pp. 59-62, 76, figs. 10).—A portable recording dynamometer using an internal-combustion motor as a prime mover is described, which was recently developed at the Ohio State University. Its purpose is to indicate the power requirements of belt-drive machinery.

Studies of the power required in threshing showed that careless pitching of bundles caused the thresher to consume 19.3 per cent more power than steady pitching. When the grain was thoroughly dry the horsepower consumption was 4.7 per cent less, although the rate of pitching was faster. Wheat threshing consumed 22.69 per cent more power than oats.

In hay and straw baling the horsepower requirement decreased as the density of the material to be pressed increased. In ensilage cutter tests even feeding required 14.5 per cent more power than uneven feeding. While the data seemed to favor uneven feeding, erratic feeding caused severe strains on both the cutter and prime mover. Dull knives utilized 14.78 per cent more power than sharp knives, and the power consumption was inversely proportional to the length of cut.

**Farm equipment for mechanical power**, F. N. G. KRANICH (*New York: MacMillan Co.*, 1923, pp. XIV+405, figs. 320).—This book deals with farm machinery and its operation, with particular reference to the use of mechanical power. Part 1 on draft machinery contains chapters on the plow, harrows, land rollers and pulverizers, drills and seeders, mowing machines, haying machinery, grain binders, corn binders, push binders and headers, combined harvesters, manure spreaders, wagons, road machinery, miscellaneous machines, and testing machinery for draft. Part 2 on belt-driven machinery contains chapters on belt speeds, lining up and setting, threshing machinery, silage cutters, corn shellers, husker shredders, clover hullers, pea and bean



threshers, feed grinders, wood saws, baling presses, and irrigation pumps. Part 3 on miscellaneous topics contains chapters on engine cultivators, garden tractors, belts and belting, pulleys and pulley coverings, chains and sprocket wheels, lubricants and lubrication, tools and shop equipment, housing machinery and winter storage, and ordering repair parts.

**Fertilizer distributors**, G. FISCHER (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 2, *Wirtschaft.-Prakt.*, pp. 92-97).—This is a brief discussion of the important points to be considered in the development of fertilizer distributors, particularly for the more dusty fertilizers.

**Measuring heat transmission in building structures and a heat transmission meter**, P. NICHOLLS (*Jour. Amer. Soc. Heating and Ventilating Engin.*, 30 (1924), No. 1, pp. 35-70, figs. 30).—This paper deals with the measurement of heat flow through walls, more particularly of existing structures, outlining the principles employed, and describes in detail work done in the research laboratory of the American Society of Heating and Ventilating Engineers in an attempt to develop a heat transmission meter which will indicate instantaneous flows. A short review of the present state of available knowledge, future requirements, and indications of the probable trend of investigational work on the subject is included.

**A method of automatic control of low temperatures employed by the U. S. Department of Agriculture**, J. T. BOWEN (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 4, pp. 183-190, figs. 4).—The method and the apparatus involved are described and illustrated, and their application to greenhouses is outlined.

**Heat emission from heating surfaces of furnace**, A. P. KRATZ (*Jour. Amer. Soc. Heating and Ventilating Engin.*, 30 (1924), No. 1, pp. 29-33, figs. 3).—A study of several series of warm-air furnace tests conducted under varying conditions with a cast-iron circular radiator type of Warren air furnace operating on anthracite coal is reported. The purpose was to indicate the amount of heat emission from the heating surface of a warm-air furnace and the relative value of the different parts of the heating surface as a basis for the intelligent design of such furnaces.

The heat emission per square foot of heating surface was found to be independent of the type of casing or bonnet for a given set of castings. In the furnace tested, approximately 30 per cent of the total heat emission came from the fire pot, 40 per cent from the combustion chamber, 24 per cent from the radiator, and 6 per cent from the ash pit. For a cast-iron circular radiator type of furnace, 1 sq. ft. of surface in the fire pot is equivalent to approximately 1.9 sq. ft. in the combustion chamber, 5.9 sq. ft. in the radiator, and 6.7 sq. ft. in the ash pit. At a mean combustion rate of 7 lbs. per square foot of grate surface per hour, approximately 75 per cent of the heat emitted by the heating surfaces appeared as useful heat in the air circulated, based on the heat in the air at the bonnet of the furnace.

**Furnace heating**, W. G. SNOW (*New York: U. P. C. Book Co., Inc.*, 1923, 6. ed., rev. and enl., pp. 250, figs. 74).—This is the sixth edition of this treatise on warming buildings with hot air. It contains chapters on furnaces; househeating; the one-pipe system; the combination system; air, humidity, and ventilation; the heating and ventilation of school buildings; heating of public buildings, churches, and stores; the fan furnace combination system; temperature control; estimates and contracts; fuels, miscellaneous tables, and data; furnace erection and fittings; and miscellaneous notes and data on furnace heating.

**Turn on the light**, F. W. DUFFEE and G. W. PALMER (*Wis. Agr. Col. Ext. Circ.* 163 (1923), pp. 48, figs. 13).—Practical information on different lighting ap-



pliances which may be profitably used on Wisconsin farms is presented. A discussion of rural transmission lines is also included.

**Principles and practices of upkeep painting** (*Philadelphia: E. I. du Pont de Nemours & Co., Inc., 1923, pp. 200, pls. 6, figs. 38*).—The purpose of this book is to cover in simple practical fashion modern painting practice for all types of exterior and interior surfaces. It shows the reasons for decay and deterioration, describes proper methods to follow in conquering these destructive forces, indicates the part that paint and varnish play in upkeep work, and emphasizes the importance of using high-quality materials for all painting purposes.

**The O. A. C. portable colony house**, A. G. LUNN (*Oregon Sta. Circ. 52 (1923), pp. 4, pl. 1, figs. 2*).—Drawings and a bill of material for the construction of this house are given.

**How to convert the O. A. C. portable colony house into a brooder house**, A. C. LUNN (*Oregon Sta. Circ. 52, Sup. (1923), pp. 2, fig. 1*).—Directions are briefly given.

**The model cow stall**, J. O. TRETSVAN and H. E. MURDOCK (*Mont. Agr. Col. Ext. [Pub.] No. 63 (1923), pp. 4, figs. 4*).—Practical information, including working drawings, on the construction of a simple and practical cow stall is presented.

**Present status of sanitary engineering; suggestions for objects and aims of the sanitary engineering division**, H. P. EDDY (*Amer. Soc. Civ. Engin. Proc., 50 (1924), No. 1, [pt. 3], pp. 3-12*).—The present status of sanitary engineering is discussed, and the objects and aims of sanitary engineering work are outlined under the subjects of water supply and purification; sewerage, drainage, and the disposal of sewage and industrial wastes; refuse collection and disposal; eradication of the mosquito and other vermin which may carry infection; and air supply and purification.

**Influence of temperature on the removal of bacteria from drinking water by chlorin gas**, HILGERS and L. TIETZ (*Gesundh. Ingen., 46 (1923), No. 34, pp. 329-331*).—Studies conducted at the University of Königsberg are reported, which showed that under practical conditions where a large excess of chlorin is used to destroy a relatively small number of bacteria, the temperature of the water is of so little consequence as to be negligible.

## RURAL ECONOMICS AND SOCIOLOGY.

**Agricultural organization in the United States**, E. WUEST (*Lexington: Univ. Ky., 1923, pp. XXIII+618, pls. 2, figs. 10*).—An account of the U. S. Department of Agriculture occupies 185 pages of this work, and in it the history and activities of the various bureaus and offices are separately and briefly described. Among other State and Federal agricultural organizations, the land-grant colleges, the experiment stations, the cooperative agricultural extension work, agricultural education under the Smith-Hughes Law, and the State departments of agriculture are given a chapter each. The private organizations described include State and national agricultural societies, the Grange, the Farmers' Alliance, the Farmers' Union, the American Farm Bureau Federation, and miscellaneous societies and breed associations. The concluding chapter presents a discussion of the farmer and the class struggle.

**Farm management**, W. J. SPILLMAN (*New York: Orange Judd Pub. Co.; London: Kegan Paul, Trench, Trubner & Co., Ltd., 1923, pp. [8]+474, figs. 45*).—The physical, biological, and economic factors that control the selection of farm enterprises are discussed in this treatise and textbook on farm management, and data from farm management surveys and much hitherto unpublished material in the Bureau of Agricultural Economics, U. S. D. A., are used in



illustration. The problems of capital in farming, the extent of particular farm enterprises, the distribution of types of farming, the status and economic and physical limitations of specific crops including cereals; hay, forage, and cotton; fruit and truck crops; and minor crops including sugar, tobacco, and others, are discussed, as well as the position of livestock enterprises, such as dairying, beef cattle, sheep, hogs, and poultry.

Three phases of farm organization are distinguished as financial, physical, and business organization. The first treats of the farm capital and its distribution between the different classes of farm property, land, buildings, livestock, implements and machinery, feed and supplies, and cash or credit for current expenses. The physical organization of the farm implies the location and arrangement of the farmstead and the subdivision of the farm into pastures, fields, etc. Under business organization is discussed the kinds of crops to grow, the acreage of each, the kinds and numbers of animals to keep, and the character and quantity of equipment required or desirable. The findings of farm management surveys in particular localities representative of New England and the Corn Belt are then considered. Farm management problems associated with the seasonal distribution of labor in sections of the United States are discussed. A chapter on tenancy deals briefly with the three phases of the problem the tenant has in passing from the tenant into the owner class; the type of tenancy, whether share, cash, or other; and the character of the contract between the landlord and tenant.

**Buying a farm in an undeveloped region**, B. HENDERSON (*U. S. Dept. Agr., Farmers' Bul. 1385 (1924), pp. II+30, figs. 3*).—This publication sets forth the capital needed, important considerations in purchasing a farm, sources of credit, and the advantages of acquiring information and experience. Data have been compiled from a study by Stewart previously noted (*E. S. R., 46, p. 388*) and from nine additional surveys including 30 regions of the United States, and are tabulated to show the size of initial payment that would be necessary at the time of purchase in order to amortize the debt on the farm in 10, 20, or 30 years, when the family uses nothing, \$300, or \$600 annually from the farm income for expenses. It appears that the Palouse area in Washington and Idaho requires the largest initial payment of those studied, next to which is the region covered by the surveys of Blackhawk, Tama, and Grundy Counties, Iowa. The easiest region in which to pay for a farm is in Polk County, Fla., where a \$44,813 farm may be paid for in 20 years without any initial payment and allowing \$600 per year for family expenses. Allowances are made, however, in noting these data for the nature of crops grown and the years in which the surveys were made. A number of compound interest and amortization tables are presented.

**Increasing the farmer's net income by reducing costs**, O. R. JOHNSON (*Missouri Agr. Col. Ext. Circ. 135 (1923), pp. 13, figs. 7*).—Improvement in the producing efficiency per unit of the farm enterprises is urged, and suggestions are made with reference to revising the farm layout for economy and the kind and amount of livestock necessary.

**Cost of producing farm crops**, W. R. LESLIE (*Canada Expt. Farms, Morden (Man.) Sta. Rpt. Supt. 1922, pp. 18, 19*).—Two tables summarized from records secured from an experiment in crop rotations at the experiment station at Morden, Man., show the cost of producing wheat on corn land and on western rye grass which had been pastured by sheep in the preceding year. The total cost of 9.4 acres of wheat on corn land in 1922 was \$131.59, the value per acre \$25.30, and the profit per acre \$11.30. The total cost for 2.83 acres of wheat on western rye sod was \$45.92 and the profit per acre \$12.75.

The items of expense for a rotation of six years' duration are tabulated.



**Cost of producing farm crops, S. BALLANTYNE** (*Canada Expt. Farms, Kapuskasing (Ont.) Sta. Rpt. Supt. 1922, pp. 28-32, 38, 39*).—Records of the costs of crop production at the experimental station at Kapuskasing, Ont., in 1922 are summarized in these pages.

Oats of the Banner variety seeded at the rate of 2.5 bu. per acre were grown on 29.5 acres. The total cost, including rent of land and use of machinery, plowing, disking, harrowing, seeding, harvesting, and threshing, amounted to \$24.56 per acre, or \$0.76 per bushel. The total cost per acre of 23 acres of barley was \$27.58, or \$1.04 per bushel. Hay was grown on 141 acres at cost of \$10.35 an acre, or \$9.95 per ton. In the same connection it may be noted that hay was produced on two plats of 10 acres each, one underdrained by four drains 60 ft. apart and the other undrained. The cost per acre on the first plat was \$10.41 and the cost per ton \$19.64, while on the undrained land the cost per acre was \$8 and that per ton \$20. The yield per acre in the first case was 0.53 ton, in the second 0.4 ton. The total cost per acre of producing two acres of sunflowers was \$42.44, or \$7.89 per ton. Oats, peas, and vetches for silage were produced at \$27.92 per acre, or \$6.93 per ton. One acre of potatoes cost \$100.82, or \$1.64 per bushel.

[**The yield and cost of producing farm crops**], J. A. McCLARY (*Canada Expt. Farms, Lennoxville (Que.) Sta. Rpt. Supt. 1922, pp. 15-19*).—Itemized costs of producing corn silage, sunflower silage, oats, and hay at the experimental station at Lennoxville, Que., in 1922 are tabulated. The total costs per acre were, respectively, \$38.70, \$53.78, \$29.98, and \$22.60. The cost per ton of corn silage was \$3.05 and of sunflower silage \$2.84. The cost of oats per bushel was about \$0.53, and the cost of hay per ton was \$9.83.

**Dairy farm survey, H. R. HARE** (*Brit. Columbia Dept. Agr. Bul. 91 (1921), pp. [2]+20*).—This report is based upon detailed records, including in addition to the business transacted during the year an inventory of all livestock, equipment, buildings, and land as at the beginning and at the end of the year ended April 30, 1921, as well as records of the feed which farmers bought and the milk they sold. The districts studied include Salmon Arm and Arrow Lakes districts in the interior of British Columbia, Chilliwack and Ladner in the Lower Fraser Valley, and Courtenay, Vancouver Island. The dairy farming business is described in general, and the last part of the bulletin is devoted to the details of the specialized dairy farming business.

Certain conclusions are tentatively offered on the basis of the one year's survey to the effect that dairy farms with from 26 to 45 tillable acres offered practically as great opportunity for the dairyman as the larger farms. The size of the business was a more potent factor than the size of the farm in increasing the returns. When interest on the total capital was allowed at the rate of 7 per cent, the average returns on the farms were not sufficient to allow wages to the operators of the farms, with the exception of farms of from 26 to 45 tillable acres. The employment and management of farm labor were factors which very materially affected labor incomes. Good crop yields and high quality of livestock were important items contributing to success. The average rental of leased farms equaled 4.5 per cent of the total value of the farms. The operators of owned farms received 1.9 per cent interest on investment along with wages, house rent, and farm products used in the house. The cost of producing butterfat varied on different farms from 37 cts. to \$2.52 per pound, the average cost being \$1.06. Farmers who produced butterfat at lowest cost and larger herds, sold more butterfat per cow, had better bred stock, fed more economically, handled a larger farm business, grew better crops, and used labor more efficiently than did those whose costs of production were high.



**Can a farmer acquire a farm out of his farm earnings?** W. E. GRIMES (*Kans. State Bd. Agr. Bien. Rpt. 23* (1921-22), pp. 39-46).—The point of view is taken that it is possible for the efficient men to acquire farms out of their savings.

**Financing agriculture**, E. MEYER (*Kans. State Bd. Agr. Bien. Rpt. 23* (1921-22), pp. 22-39).—The author reviews the financial distress prevailing in agriculture before the emergency operations of the War Finance Corporation and the service rendered by it in financing livestock marketing and in making loans to cooperative marketing associations. Some fundamental principles of agricultural finance are discussed, with special reference to the Federal reserve system.

**Joint-stock land bank bonds, with special reference to the bonds of the San Antonio Joint Stock Land Bank**, G. HUSTON (*Chicago: Caldwell, Mosser & Willaman, Inc.*, 1923, pp. [2]+29, fig. 1).—This booklet describes the issuance and security and the benefit to agriculture of this type of credit.

**Agricultural credit in Italy**, J. CARLOTTI (*Jour. Agr. Prat., n. ser.*, 40 (1923), No. 36, pp. 189-191).—A brief résumé is given of credit organization, particularly in the north of Italy where it began as an independent movement among producers.

**Cooperative farm insurance**, J. R. THORNE (*Kans. State Bd. Agr. Bien. Rpt. 23* (1921-22), pp. 11-15, fig. 1).—This sets forth the requisites of success in mutual farm insurance companies, describing various phases of the organization and management of such companies, with special reference to a fire, tornado, and hail association operating in eastern Kansas.

**The traffic dictionary**, compiled by G. T. STUFFLEBEAM (*New York: Author*, 1923, 2. ed., rev., pp. 170).—This is a glossary of domestic and foreign trade and shipping terms, phrases, and abbreviations, together with the names and kinds of technical documents, publications, equipment, and services employed in transportation.

**Fundamental principles in marketing farm products**, E. W. COLE ([*Austin, Tex.*]: *State*, 1921, pp. 33).—The topics of demand, production, supply, consumption, harvesting, protection, containers, grades and packs, advertising, tariffs, storage, and selling and distribution of agricultural products are briefly discussed.

**Marketing milk in six cities of Kansas**, F. L. THOMSEN (*Kansas Sta. Bul. 230* (1923), pp. 3-32, figs. 2).—The six cities of Wichita, Topeka, Salina, Emporia, Dodge City, and Concordia were selected as representing fairly typical conditions throughout the State. Data were obtained by questionnaires and personal visits to as many of the agencies distributing milk in each of these six cities as could be reached.

It was found that in general the milk supply of these centers was usually produced on nearby farms. Data are tabulated and discussed as pertaining to the quality of the market milk tested in the several cities, the demand and the market, the marketing processes, and the cost. More adequate inspection and grading are deemed necessary, and it is held that more efficient methods of delivery, especially through producers' or distributors' organizations, should be developed.

**Commercial harvesting, grading, and marketing of lettuce in South Carolina**, F. L. HARKEY and D. D. WHITCOMBE (*Clemson Agr. Col. S. C., Ext. Bul. 56* (1923), pp. 15, figs. 8).—Suggestions are offered with reference to the selection of heads, packing, and refrigerating. South Carolina grades for head lettuce are defined.

**Cooperative cotton marketing in Arkansas**, E. A. HODSON (*Ark. Agr. Col. Ext. Cir. 156* (1923), pp. 23, figs. 2).—An introductory discussion of cooperative

marketing in general is contributed by B. Knapp. The history of cooperative cotton marketing associations and of the standard contract and the laws of several States dealing with such organizations and their methods are reviewed.

**Regulations of the Secretary of Agriculture under the U. S. Warehouse Act of August 11, 1916, as amended.**—**Regulations for peanut warehouses, approved September 29, 1923** (*U. S. Dept. Agr., Bur. Agr. Econ. Serv. and Regulat. Announcements* 81 (1923), pp. IV+33).—A draft is presented of the rules and regulations of the Secretary of Agriculture for warehouses storing farmers' stock peanuts under the U. S. Warehouse Act. The text of the act is also included.

**Merchandising farm products**, T. MACKLIN (*Wis. Agr. Col. Ext. Circ.* 161 (1923), pp. 23, figs. 3).—This is a brief for commodity marketing organization.

**The commercial outlook for American wheat, corn, and pork products** (*Econ. World, n. ser.*, 26 (1923), No. 3, pp. 78, 79).—This report of the commercial outlook for these products as of July 13, 1923, has been noted from another source (*E. S. R.*, 49, p. 693).

**Factors affecting the price of farm products**, H. C. FILLEY (*Nebraska Sta. Bul.* 198 (1923), pp. 40, figs. 14).—A discussion of the forces of supply and demand, cost of production, market strategy, monopoly, the quantity of money in circulation and the rapidity with which it circulates, credit, transportation and commercial costs, and import duties is presented in these pages. Graphs and tables are also given, showing the price trends of potatoes, wheat, corn, and oats, and hog receipts and prices, in many cases for the period of years since 1866.

**Prices of farm products**, J. I. FALCONER (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 11-12, pp. 163-166).—A review is given of the characteristics of the relation between the supply of farm products and their price, as exhibited by the average annual yield of potatoes in the United States and also, though in less degree, by that of corn and wheat. Seasonal fluctuations in the price of crops due to the large supply at harvest time and of livestock in months of maximum and minimum supply on the market are also shown.

**A graphic summary of New Jersey agriculture**, H. B. WEISS (*N. J. Dept. Agr. Bul.* 36 (1923), pp. 263-340, pl. 1, figs. 88).—The geography, soils, population, forests, and temperature and precipitation of New Jersey are mapped. A series of dot maps represents the distribution of crops and livestock and other phases of agricultural and related industries.

**English country life and work**, E. C. PULBROOK (*London: B. T. Batsford, Ltd.*, 1922, pp. IX+243, pls. 2, figs. 176).—This volume constitutes a sketch of life and occupations in the fields, villages, woodlands, and watersides of rural England, as well as of traditional sports and recreation and worship. It is profusely illustrated.

**A bird's-eye view of the present situation of Belgian agriculture**, J. VANDER VAEREN (*Rev. Gén. Agron., n. ser.*, 13 (1923), No. 3-4, pp. 65-84).—This is a statistical review of the area cultivated, agricultural population, land values, taxes and tariffs, the regional distribution of the principal crops and the livestock industry, the capital invested in agriculture, and the balance of trade in foodstuffs for Belgium.

**Agrarian reform in Czechoslovakia**, edited by E. VONDRUŠKA and A. PAVEL (*La Réforme Agraire en Tchécoslovaquie. Prague: Off. Foncier État*, 1922, pp. 31).—The laws recently enacted providing for the expropriation of large estates, the division of the land, forest management, and credit facilities are discussed briefly. Three tables in the appendixes present statistics of landholdings in Bohemia, Moravia, and Silesia and in Czechoslovakia.



**Family living in farm homes.**—An economic study of 402 farm families in Livingston County, N. Y., E. L. KIRKPATRICK, H. W. ATWATER, and I. M. BAILEY (*U. S. Dept. Agr. Bul. 1214* (1924), pp. 36).—The study reported upon in this bulletin was carried on cooperatively by the U. S. Department of Agriculture and the New York State College of Agriculture at Cornell University. It is the first of a projected series to be made in different sections of the United States, the primary purpose being to develop a method for obtaining statistical data indicative not merely of the cost but also of the quality of family living. Of the 402 farms in the northern part of Livingston County which were included in the study, 295 were operated by owners and 107 by tenants. The returns cover the year ended September 1, 1921. There is shown the cost or value of the principal goods consumed during the 12 months, the kinds and qualities of food materials and clothing used, the value of house and house furnishings, the prevalence of certain facilities affecting the comforts and convenience of the house, the education of the members, and other items commonly considered indicative of the standard of living. The suggested classification of family goods includes the items of food, clothing, housing, furnishings and equipment, operation, maintenance of health, advancement, personal expenditures, savings, Government or taxes not charged to housing or the farm business, and unclassified items.

Expenditures for all purposes averaged \$2,012. Of this about one-third was provided without direct purchase. The farm furnished food materials worth on the average \$399 or about 50 per cent of all food, fuel worth \$59 or about 41 per cent of all fuel, and rent estimated at \$234. Unpaid labor had an average value of \$33 per family, and gifts of clothing \$4. Food, clothing, and rent represented, respectively, 39.5, 13.8, and 11.6 per cent of all expenditures. The average value of house furnishings was estimated at \$822. Fuel represented 7.1 per cent of all expenditures, and other items 6.2 per cent. Formal education entailed 1.8 per cent of total expenditures, contribution to church organizations 2 per cent, the cost of operating and repairing the automobile for family and household use 3.2 per cent, and savings 2.1 per cent.

An attempt was made to devise scales by which families of various make-up might be reduced to common units of comparison. In the case of food the scale of dietary factors noted previously (*E. S. R.*, 13, p. 974; 49, p. 158) was taken as a basis. In each of the other classes of goods the records of the Livingston County families were examined to find the ratio between expenditures for individuals of different age, sex, and occupation. The sum of the ratios or factors representing all members of the family or household was termed the household-size index. By dividing the expenditure for any item by this index, a figure was obtained which was termed the expenditure per cost-consumption unit for that item. The sum of the expenditures per cost-consumption unit for the various items was used as the basis of comparison for families or groups of families. The expenditure per cost-consumption unit and the proportion devoted to advancement both increase fairly regularly with the size of the farm business and with the value of the house and its furnishings. They also increase with the extent of formal education received by operators and home makers and even more markedly with the education received by children. They increase less definitely with contributions to church organizations and church attendance.

**Agricultural forecasting**, H. C. TAYLOR (*Vocat. Ed. Mag.*, 2 (1924), No. 5, pp. 362-369, figs. 4).—This paper is essentially the same as an address before the American Farm Economic Association meeting, December, 1923 (*E. S. R.*, 50, p. 199). A general introduction to the problems of forecasting is given, and



some of the work of the U. S. Department of Agriculture in collecting data on the basis of which forecasts of production may be made is described, particularly the intention surveys.

**Exports of agricultural products from the United States to the industrial area of Europe** (*Econ. World, n. ser.*, 26 (1923), No. 3, p. 83).—This statement, prepared by the U. S. Department of Commerce, sets forth briefly statistics of the export trade of the United States to the United Kingdom, Germany, France, Netherlands, Italy, and Belgium in pre-war years and in 1920 to 1922, inclusive.

**A report to the minister of agriculture, industry, and commerce, A. T. FILHO** (*Relat. Min. Agr. Indus. e Com. [Brazil]*, 1921, pp. 88).—This is a statistical report on production and export trade in agricultural products, land prices, wages of agricultural labor, and related topics for Brazil, mainly for the year 1921.

**[Agricultural statistics of Rumania]**, I. TEODORESCU (*An. Statis. României*, 1922, pp. 42-62, 66, 68-110).—The official statistics presented here apply for the first time to the whole of the present kingdom of Rumania.

**Raw products of the world.—I, Africa**, R. DAVOL (*Taunton, Mass.: Davol Pub. Co.*, 1922, pp. [2]+264, pl. 1).—This is a compilation of statistics of agricultural and livestock production and native products.

## AGRICULTURAL EDUCATION.

**Rural school management**, I. G. BARNES (*New York: Macmillan Co.*, 1923, pp. XV+303, pls. 16, figs. 2).—School management is defined as that directing of the everyday business of a school which results in the largest gains of practical knowledge and skill, useful habits, and desirable feelings and attitudes, with the least friction and waste. The constructive force lies in the fixing of ideals and habits of conduct. The contributing factors to the school management problems of the teacher, the pupils, and their attitudes; the school building and equipment in their effect upon ideals and conduct; the course of study; the rural school program; methods of teaching; the rural school library; the direction of play and recreation; the hot lunch; regular attendance; the attitude of the community; and the teacher's aids are discussed at length.

**Elementary rural school agriculture**, E. WINDES (*Jour. Rural Ed.*, 3 (1923), No. 3, pp. 97-104).—The author holds the viewpoint that rural elementary education should not limit the occupational choice of children in rural districts, and that the study of agriculture in the elementary school should provide an impartial survey of the conditions of getting a living through agriculture and should make such comparisons with other occupations that the boy will have a basis of intelligent choice. Major objectives and the general content of an agricultural course are outlined.

**Agricultural education in Ontario**, J. B. DANDENO (*Agr. Gaz. Canada*, 11 (1924), No. 1, pp. 46-55).—It is intended to present here an outline of the history of agricultural education in Ontario, covering especially those activities which are carried on under the department of education. These activities are concerned only with schools below college grade, including public and separate schools and high schools. Upon the establishment of the first normal school in Ontario at Toronto in 1847, provision was made for instruction in agriculture in the regular daily program. In order to show the scope of the course given in the normal school over 75 years ago, a copy of the final examination questions is given here.

**A six-year review of the College of Agriculture, National Southeastern University, Nanking, China, 1917-1923** (*Nanking: College Press*, 1923, pp.



[42], pls. 16).—This college is an outgrowth of the department of agriculture of the Government Teachers' College, which was founded in September of 1917. Upon the inauguration of the National Southeastern University on April 9, 1922, the department of agriculture became a separate college in the university. The history of the college is treated under the topics of a review of the past six years, the organization and present situation of the different departments and of the experiment stations, and plans for the next fiscal year. The college is organized into seven departments of biology, agronomy, horticulture, animal husbandry, sericulture, plant pathology and entomology, and the utilization of farm products. Experiments at the central station, located at Tashengkwan, about 15 miles west of Nanking City, are confined to the staple crops of the region, such as rice, wheat, and beans. The nine sub-stations are designated for experiments in animal husbandry and floriculture, wheat, fruit and vegetables, and cotton.

**The organization and function of the winter schools of agriculture** (*Vie Agr. et Rurale*, 23 (1923), No. 47, pp. 366-368).—The text is given of a decree of minister of agriculture of October 23, 1923, with regard to the organization and teaching program of winter schools of agriculture in France.

**Experiments with the problem method of teaching**, E. R. HENSON (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 11, pp. 448-453).—A method of handling laboratory work in the crops seminar and in crop management courses is set forth here.

**Home economics in negro schools**, C. A. LYFORD (*Jour. Home Econ.*, 15 (1923), No. 11, pp. 633-637).—A brief review is presented of the establishment of home making courses in industrial schools for negroes and in elementary schools under the Jeanes Fund supervisors, county training schools established through the Slater Fund, provisions for negro teacher training, and extension work for negroes.

**Application of general methods to the teaching of nutrition**, M. G. McCORMICK (*Jour. Home Econ.*, 15 (1923), No. 11, pp. 619-623).—This article is based on an address by W. H. Kilpatrick. It is a discussion of the formation of correct food habits, the development of the right attitude in children toward these habits and the furnishing them with information about their nutritive requirements.

**Nutrition handbook**, M. M. HUNTER (*Mont. Agr. Col. Ext. [Pub.] No. 62* (1923), pp. 47, fig. 1).—Eleven lessons in health and foods are presented, together with score cards, tables, and other suggestive materials.

## MISCELLANEOUS.

**Report of Alaska Stations, 1922**, C. C. GEORGESON (*Alaska Stas. Rpt. 1922*, pp. [2]+25, pls. 2, figs. 7).—This contains the organization list and a report of the several lines of work carried on during the fiscal year ended June 30, 1922. Meteorological data and accounts of the extensive tests with field and garden crops are abstracted elsewhere in this issue.

**Forty-second Annual Report of New York State Station, 1923**, R. W. THATCHER (*New York State Sta. Rpt. 1923*, pp. 50).—This, the final report of the station under separate management (E. S. R., 49, p. 2), contains the organization list, a review of the work and publications of the station, and a financial statement for the fiscal period from December 1, 1922, to June 30, 1923. The experimental work reported is for the most part abstracted elsewhere in this issue.

**Report of Porto Rico Station, 1922**, D. W. MAY ET AL. (*Porto Rico Sta. Rpt. 1922*, pp. [2]+18, pls. 4, figs. 6).—This contains the organization list, a sum-

mary by the agronomist in charge as to the general conditions and lines of work conducted at the station during the year, and reports of the chemist and assistant chemist, horticulturist, plant breeder, assistants in plant breeding and horticulture, entomologist, specialist in farm management, and acting plant pathologist. The experimental work reported is for the most part abstracted elsewhere in this issue.

**Report of the Virgin Islands Station, 1922**, J. B. THOMPSON and C. E. WILSON (*Virgin Islands Sta. Rpt. 1922*, pp. [2]+18, pls. 4, figs. 4).—This includes the organization list and a report by the agronomist in charge as to the work of the station for the fiscal year ended June 30, 1922. A report of the entomologist is included. The experimental work reported is for the most part abstracted elsewhere in this issue.

**Monthly Bulletin of the Ohio Experiment Station** (*Ohio Sta. Mo. Bul.*, 8 (1923), No. 11-12, pp. 161-191, figs. 12).—This number contains six articles abstracted elsewhere in this issue.

**Bimonthly Bulletin of the Western Washington Station** (*Western Washington Sta. Bimo. Bul.*, 11 (1924), No. 5, pp. 89-112, figs. 3).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Fourth Western Washington Egg-laying Contest, by Mr. and Mrs. G. R. Shoup; Dormant Spraying, by A. Frank; and Grapes in Western Washington, by H. D. Locklin.



## NOTES.

---

**Purdue University.**—Work on the new poultry building is well under way and most of the exterior is completed.

A new building is to be erected for the university at the State Fair Grounds. As projected, it will be 250 by 75 ft. and centrally located. In addition to a large exhibit and demonstration room, there will be an auditorium seating 500 people. It is hoped to complete the building before the next State Fair in September.

**Michigan College.**—An engineering experiment station has been established, supervision being vested in the dean of engineering. N. A. Kessler has been appointed land clearing specialist, effective January 1.

A number of Holstein cattle were recently given the college by Corey J. Spencer of Jackson to be auctioned off during farmers' week. The proceeds are to be used for student loans, preferably to agricultural students.

Walter H. French, head of the department of education and for many years assistant superintendent of public instruction for Michigan, died January 1.

**Nevada Station.**—The departments of range management and chemistry have begun a study of the so-called alkali poisoning of cattle in southern Nevada. It is thought that the actual cause may be due to some poisonous plant.

**Pennsylvania College.**—The resignations are noted of Paul Seese, assistant in plant pathology extension, effective March 15, and A. L. Strand, assistant professor of entomological extension, effective April 15. G. F. Miles and R. S. Kirby have been appointed assistant professors of plant pathology extension, beginning February 10 and March 1, respectively.

**Agricultural Extension and Home Economics Work in Spain.**—A recent issue of the *A. B. C.* of Madrid announces that a short course in agriculture was given by the General Association of Animal Husbandmen in the Casa de Campo from February 1 to March 10, to which people of both sexes over 14 years of age and with elementary education were eligible. It was followed by a similar course on the care and feeding of animals, special attention being given to hygiene and sanitary methods, and a study of milk and its related industries, this course being scheduled from March 17 to May 1. Courses are also being offered in poultry farming and bee raising from April 1 to May 1.

**Necrology.**—Dr. Jacques Loeb, internationally known for his researches in biology and chemistry, died February 12 at the age of 65 years. Dr. Loeb was a native of Germany, coming to this country as professor of biology at Bryn Mawr College in 1891. Subsequently he served as professor of physiology and experimental biology at the University of Chicago from 1892 to 1903, at the University of California from 1903 to 1910, and from that time to his death as a member of the Rockefeller Institute for Medical Research. The subjects included in his very extensive contributions to science included heliotropism; heteromorphosis, organization and growth; comparative physiology of the brain and comparative psychology; dynamics of living matter; artificial parthenogenesis and fertilization; the mechanistic conception of life; the organism as a whole; forced movements, tropisms, and animal conduct; and, more recently, the physical chemistry of the proteins and the theory of colloidal behavior. Probably the works for which he is most widely known are his mechanistic conception of life and the generation of life without spermatozoa.

**New Journals.**—*Zhurnal Opytnoi Agronomii iugo-Vostoka* (*Journal of Experimental Agriculture in Southwest European Russia*) is being published at Saratov by an editorial committee consisting of W. R. Zalensky, G. K. Meister, E. I. Panfiloff, F. P. Savarensky, and N. M. Tulajkoff. The initial number contains several original contributions with German or English summaries, including the following: The Division of the Southwest into Agricultural Districts, by F. Savarensky; The Effects of Preceding Crops on Spring Wheat, by W. Pokrowsky (E. S. R., 49, p. 231); A Study of a Cross between Two Distinct Species of *Triticum durum* and *T. vulgare*, by G. Meister (E. S. R., 49, p. 36); The Chemical Composition of Chaff, Grain, and Vegetables in the Middle Volga Region, by D. Liskier; and The Drought in the Samara Government of Russia in 1921, by D. Shchukin (E. S. R., 49, p. 209).

*The Empire Cotton Growing Review* is being published as the organ of the Empire Cotton Growing Corporation. The initial number contains an account of the history of the corporation and its aims and accomplishments, and several original articles, one of which, by Sir Francis Watts, deals with the work of the Imperial College of Tropical Agriculture. Another article, by L. H. Burd, is entitled A Preliminary Note on a Sterile Dwarf Rogue in Sea Island Cotton. A biographical article discusses appreciatively the life and work of the late William Robson, curator of the Botanic Station of Montserrat from 1905 to 1923. Cotton growing statistics, notes on current literature, etc., are included.

*I Problemi della Nutrizione* is being published as a journal of clinical and dietetic physiology and pathology. The initial number contains original articles entitled The Hemoglobin Exchange in Physiological and Pathological Conditions, by E. Greppi; The Determination of Sugar in Blood, by M. Fonda; The Preparation of Insulin and Its Action and The Actual State of Knowledge on Insulin, both by V. Ascoli; a discussion of the latter paper by members of The Italian Medical Society and others; and various notices and abstracts.

*Milchwirtschaftliche Forschungen* contains in its initial number articles on The Influence of the Feed on the Composition of the Milk Fat, by F. Kieferle; The Hardening Point of Butterfat, by O. Rahn; Investigations on Sweet and Sour Milk, by J. Drost, M. Steffen, and E. Kollsted; The Breeding of Mangels, by Kiesel; Milk Studies, by W. Grimmer; and Dairying and Animal Diseases, 1914-1920, by Carl; together with numerous abstracts.

*Agricultura* is a new monthly issued as the official organ of the General Agricultural Association of Guatemala. The initial number deals largely with the work of the association, but contains various articles on agricultural topics, administrative orders, notes, etc.

**Miscellaneous.**—The British Ministry of Agriculture and Fisheries has begun a series of experiments on the effects of inbreeding and outbreeding on egg laying qualities in poultry. The work is to be carried on as a project of the National Poultry Institute at the Reaseheath School of Agriculture at Nantwich, Cheshire.

F. R. Parnell, economic botanist to the Government of Madras, has been appointed plant breeder to the Empire Cotton Growing Corporation. S. Milligan, agricultural adviser to the Government of India, is to be in charge of the work, having accepted an appointment with the corporation to advise the Government of the Union of South Africa on all matters connected with cotton growing.

According to a report recently received from the American Legation at Belgrade, the Minister of Agriculture announces the opening this spring of a school of agriculture and viticulture at Knin in Dalmatia.



# EXPERIMENT STATION RECORD.

VOL. 50.

MAY, 1924.

No. 7.

The recent completion and occupancy of the magnificent building erected at the Nation's Capital for the use of the National Academy of Sciences and the National Research Council is an event well worthy of mention by every scientific journal. In the words of President Coolidge, the new structure constitutes what may be termed "a Temple of Science in America." It is at once a recognition of the achievements of science in the past and a visualization of its outstanding importance in the national economy of the future.

The new building is attractively located on a site fronting and overlooking the Lincoln Memorial. This location is itself peculiarly appropriate, since the charter of 1863 establishing the National Academy was signed by President Lincoln. Nor should it be forgotten that it was the same Chief Executive who approved two other pieces of legislation of large significance to science, one the original Morrill Act of 1862 making provision for the land-grant colleges and the other the act of the same year calling into being the Federal Department of Agriculture.

The building is of simple classical design, richly embellished with appropriate sculptural and mural decoration. The massive bronze entrance doors depict eight episodes in the history of science from Aristotle to Pasteur. A marble pseudopediment above the doorway portrays the sculptor's conception of the elements with which science has to do, including earth and cloud through the various forces of the animal and vegetable kingdom to man, and surmounted by the sun, the source of warmth and light. A series of six large bronze panels presents the outstanding leaders of science from ancient to modern times.

Many similar devices adorn the structure at other points. Especially may be mentioned the inscription at the base of the central dome, which reads as follows:

"To Science, Pilot of Industry, Conqueror of Disease, Multiplier of the Harvest, Explorer of the Universe, Revealer of Nature's Laws, Eternal Guide to Truth."

In several of these characterizations the applications to agriculture are apparent.

The main floor of the building contains a library and reading room, a small room for meetings, and a central auditorium surrounded by exhibit rooms. The second and third floors contain offices for the use of the Academy, the Research Council, and certain other closely related bodies. Hitherto the Academy has had its headquarters under congested circumstances in the Smithsonian Institution, while the Council has been in rented quarters, so that the new building means a very great improvement in the adequacy and convenience of their available facilities.

The funds for the new building were contributed entirely from private sources. The land was the joint gift of more than a score of donors, while the cost of the structure itself was defrayed from a grant of five million dollars by the Carnegie Corporation of New York in 1919. Not all of this amount was expended for its erection, however, the greater part remaining as a permanent endowment for the maintenance of the building and the support of the work of the National Research Council.

Although the Federal Government was not a financial participant in the building program, its interest in the institution is both immediate and considerable. The Academy under its charter is required, whenever called upon by any Department of the Government, "to investigate, examine, experiment, and report upon any subject of science and art," and this function has been frequently performed in time of need. Similarly, the Research Council, organized in 1916 to centralize the scientific resources of the Nation for utilization in the event of hostilities, was perpetuated after the close of the World War at the request of President Wilson with a view to stimulating research in the mathematical, physical, and biological sciences, organizing comprehensive research projects of broad scope, and securing widespread cooperation among scientists in their solution. As is well known, many of the activities of the Council in the biological sciences have dealt with matters of direct application to agriculture.

The interest of the Government was forcefully expressed by President Coolidge in an address at the dedication of the new building. Briefly recounting some of the incidents which illustrate the concern of various Presidents in the promotion of science, he said:

"One of the most important possibilities for service of the National Academy of Sciences in the future lies in its opportunity for inspiring the people of America to insistence upon having the truth, and nothing but the truth, regarding everything that touches our life as a Nation. It is always to be borne in mind that while the peculiar relation of the Academy to the Government of the United States may concern the conduct of specific researches, the example of dignified emphasis upon the truth as reached by correct thinking in every department of research and in its practical applications may be a



contribution of inestimable value to the whole people. It is for this purpose that the Government sets its stamp of approval upon this effort, and joins in dedicating this building to the betterment of the human race by achieving a clearer knowledge of the truth."

This broad conception of the fundamental aims of science deserves consideration by all who enlist in its service or profit by its undertakings. It is well that these ideals of science have been exemplified by the substantial structure now dedicated in its name.

As the years go by, interest in the origin and history of the various institutions engaged in the promotion of agricultural education and research tends to increase. This is fortunate, for it serves as a stimulus to the collection and utilization of the rapidly dwindling sources of original information. Contributions to the literature which throw light on the early days are of course especially welcome under these conditions.

Two publications have recently appeared to which attention may well be called from this point of view. One of these is an account of the life and public services of Senator Justin Smith Morrill, widely considered the proponent and sponsor of the land-grant colleges. The other is a monograph from the Institute for Government Research on the Office of Experiment Stations. While in neither case were the authors of these volumes eyewitnesses of the events of which they write, both have had access to many authentic sources for their data, and the results of their studies will doubtless be regarded as quite authoritative.

The biography of Senator Morrill is based to a considerable degree upon letters, diaries, and miscellaneous notes, and as the author puts it, "he has left the great Vermonter as far as possible to tell his own story in his own words." This has resulted in an intimate account at close range, from which the reader can draw a graphic picture of the ideals, the ways of life, and the achievements of this remarkable statesman.

Of special interest to the readers of the *Record* is the chapter on the land-grant colleges. This deals with what the biographer considers the most notable of Senator Morrill's legislative accomplishments during an uninterrupted congressional service of over forty years. In his opinion, the land-grant college acts "not only demand a separate chapter in any account of Morrill's life, they form a chapter in the educational history of the country. Among those to whom their author is more than a name, many, if not the greater part, know him as the father of the land-grant colleges and count them as his greatest monument."

The biography presents in full a record found among Senator Morrill's papers and written in his own hand, apparently about

1874, which details the story of the events leading up to the passage of the act of 1862. In this account he states that the idea of obtaining a land grant for the foundation of colleges was in his mind as early as 1856. Although unable to recall the source of the first hint of such a measure, he states that if the purpose was not suggested by the well-known fact of the existence of agricultural schools in Europe, it was supported by this fact and especially by constant reflection on five considerations which he enumerates as follows:

"First, that the public lands of most value were being rapidly dissipated by donations to merely local and private objects, where one State alone might be benefited at the expense of the property of the Union.

"Second, that the very cheapness of our public lands, and the facility of purchase and transfer, tended to a system of bad-farming or strip and waste of the soil, by encouraging short occupancy and a speedy search for new homes, entailing upon the first and older settlements a rapid deterioration of the soil, which would not be likely to be arrested except by more thorough and scientific knowledge of agriculture and by a higher education of those who were devoted to its pursuit.

"Third, being myself the son of a hard-handed blacksmith, the most truly honest man I ever knew, who felt his own deprivation of schools (never having spent but six weeks inside of a schoolhouse), I could not overlook mechanics in any measure intended to aid the industrial classes in the procurement of an education that might exalt their usefulness.

"Four, that most of the existing collegiate institutions and their feeders were based upon the classic plan of teaching those only destined to pursue the so-called learned professions, leaving farmers and mechanics and all those who must win their bread by labor to the haphazard of being self-taught or not scientifically taught at all and restricting the number of those who might be supposed to be qualified to fill places of higher consideration in private or public employments to the limited number of the graduates of the literary institutions. The thoroughly educated, being most sure to educate their sons, appeared to be perpetuating a monopoly of education inconsistent with the welfare and complete prosperity of American institutions.

"Fifth, that it was apparent, while some localities were possessed of abundant instrumentalities for education, both common and higher, many of the States were deficient and likely so to remain unless aided by the common fund of the proceeds of the public lands, which were held for this purpose more than any other.

"Upon these points and some others I had meditated long."



A brief summary is presented of some of the various proposals which had been made both for the utilization of the public lands and the fostering of agricultural education. As the author puts it, "it is only just to say that Morrill never posed as a discoverer or inventor in the field of education. He was well aware of the progress made in the field of agricultural education abroad, and this it was which spurred his endeavors." It is pointed out as significant that Senator Morrill's initial step in this field was his introduction of a resolution in 1856, requesting the Committee on Agriculture to "inquire into the expediency of establishing one or more national agricultural schools upon the basis of naval and military schools." The author concludes that "what is clear from this brief survey is that the idea of agricultural and industrial colleges, to be supported by the State, either by donations of public lands or other subvention, was in the air. Morrill did not invent it nor discover it, but it was so congenial to his own views, it responded so closely to a need which he had experienced, that he embraced it with conviction; he framed a legislative measure which should give it effect; and he devoted himself to it with such patience, tenacity, skill, and sweet temper that after five years of labor he brought it to pass."

The view advanced some years ago that the legislation was put forward in the absence of any serious educational program as an attempt "to do something for the farmer" or "a casual bit of legislation framed to meet a political contingency" is discussed and declared to be "very far astray. It mistakes the nature of the act and the nature of the man who framed it. . . . His bill was not the work of a mere amateur nor of a mind untouched by culture. . . . His correspondence with Daniel C. Gilman of John Hopkins, Andrew D. White of Cornell, President Buckham of the University of Vermont show him in full sympathy and fellowship with the company of scholars. When he came to frame his Agricultural College Act, as it was first called, he brought to the task knowledge fully abreast of his time and ideals not unworthy a scholar. He drew the bill with an earnest desire to open college doors to farmers' sons and others who lacked the means to attend the colleges then existing. . . . There is nothing casual or contingent visible here, no appeal to party convenience, no aim to catch a passing breeze of politics."

Of events subsequent to the passage of the original act but little is said, though Senator Morrill's legislative services to the colleges of course continued with little interruption until the passage of the act of 1890. As has been indicated, however, the book contributes many valuable and interesting side lights on the earlier period, and thus constitutes an important addition to the none too numerous writings on this era.

The account of the Office of Experiment Stations now available as a result of the activities of the Institute for Government Research will excite special interest as the production of an observer unconnected with the Government and looking at its development through the eyes of an outsider. It constitutes one of a series of service monographs on various units of the Government. Over 30 of these monographs have been prepared, and this is the third to deal with a part of the Department of Agriculture. Like its associates in the series, it follows the uniform plan of taking up the history of the establishment and its development, its function expressed in terms of specific activities, its organization for handling these activities, the character of its plant, the legislation pertaining to it, financial statements of the appropriations and expenditures for a period of years, and a bibliography of the sources of information. It is wholly descriptive in character, no attempt being made to criticize the conditions as described or to suggest modifications in the methods pursued.

The monograph contains approximately two hundred pages, of which considerably more than half are devoted to the history of the Office. Under this heading is brought together a considerable mass of material dealing with the development of agricultural education and research in general. Many of the events recounted are well known, but others are gained from relatively obscure sources and are comparatively unfamiliar. The narrative is brought down to include the reorganization of last July, and thus assembles under a single cover the most comprehensive account of the evolution of the Office published thus far.

The author discusses in some detail the functions of the Office in the rendering of advice and assistance to the State experiment stations. He maintains that in this work both the "stations and the Office have benefited from the fact that the same persons have conducted the Office for more than a quarter of a century. Due to this advantage, the Office presents a unique example of national administration. It refrains from exhibiting any purpose to direct, to control, or to dominate the State stations. . . . Influence rather than coercion is the policy of the Office, and this is exerted continuously, not only through the annual visits but also through correspondence, publications, and other channels of advice and counsel. The Office sets standards, develops ideals, keeps the stations to their courses as institutions for research, and it helps to make professional service with the stations attractive and satisfactory to investigators. . . .

"The fundamental causes for these administrative principles are found not only in the long personal relationships of the inspectors to the station, but also in the historical background of the Office in the nature of the relations between the National Government and



the States and in the nature of scientific research itself. . . . The Office recognizes the fact that there is a certain incongruity in the minds of scientific men in an inspection or control of research; that the whole spirit of science is freedom of the individual to do his work in his own way, following his own initiative and exercising his own best judgment; and that the best results of research emanate from those stations that have not only procured the best investigators but have also allowed them complete freedom as to methods of research. Dominated by this spirit of scientific inquiry, the Office seeks to stimulate the efforts of the State stations through suggestion, illustration, and comparison, rather than through any form of dictation."

Another characteristic of the Office to which attention is drawn is referred to as the elasticity of the internal organization. As the author puts it, "freedom of action in shifting the personnel among the subdivisions with their ready adjustment to transitory problems is a tradition. The explanation of this lies partly in the nature of the work, and partly in the compactness of the organization. In a great measure it lies in the continuous tenure of the personnel, and in the consequent stability of the organization."

The duties of the Office as at present defined are of course such as to make continuity and consistency in policy well-nigh indispensable. In the preparation of the *Record*, for example, its utility as a permanent work of reference makes necessary a careful consideration of proposed deviations from previous practices and procedures in order to insure to its user, for instance, that material abstracted in 1924 will be handled in a fashion substantially uniform with that of a decade or more ago. Similarly, the administration of the Federal legislation pertaining to the stations is a continuing function, and the elements of consistency and permanency of policies are correspondingly vital. In any case, however, recognition of new conditions and adequate readjustments thereto are very essential, and it is hoped that the history of the Office indicates that this fact has been realized. The account just published seems to indicate a conviction on the part of the author that such has been the case, and that the Office has rendered a service to agricultural education and research which has been appreciable, distinctive, and constructive.

## RECENT WORK IN AGRICULTURAL SCIENCE.

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

**The electron in chemistry**, J. J. THOMSON (*Philadelphia: Franklin Inst.*, 1923, pp. [5]+144, figs. 41).—The five chapters comprising this volume contain the subject matter of the five lectures delivered by the author at the Franklin Institute, Philadelphia, in April, 1923.

**How chemistry helps to solve livestock problems**, J. R. MOHLER (*Chem. Age* [New York], 31 (1923), No. 12, pp. 569-571).—In this discussion by the chief of the Bureau of Animal Industry, U. S. D. A., of the relationship of chemistry and chemical engineering to the livestock industry, a brief outline is given of various chemical problems which have been or are being studied by the bureau in connection with the eradication of cattle tick, better feeding of farm animals, prevention of waste and spoilage in the meat industry, recovery of by-products in this industry, soft pork investigations, and chemical studies of milk products.

**Plant products as chemical raw materials**, W. A. TAYLOR (*Chem. Age* [New York], 31 (1923), No. 12, pp. 549-551).—This is a general discussion by the chief of the Bureau of Plant Industry, U. S. D. A., of a few of the more important plant resources that offer possibilities for utilization in chemical industries. Among the materials treated are straw, cornstalks, sugar cane bagasse and tops, long fiber by-products, soy beans, tobacco for nicotin production, tannin-producing plants, tung oil, the dasheen, bamboo, the avocado, and oriental persimmons.

**Investigations on the occurrence of iodine in nature**, T. VON FELLEBERG (*Biochem. Ztschr.*, 139 (1923), No. 4-6, pp. 371-451, fig. 1; also in *Mitt. Lebensmtl. Untersuch. u. Hyg., Eidg. Gesdhtsamt.* [Switz.], 14 (1923), No. 4, pp. 161-240, figs. 4).—This extensive report on the occurrence of iodine in nature includes a review of the literature on the subject; a discussion of various methods of determining iodine, with a description of the technique developed by the author for its colorimetric and titrimetric determination in small amounts; and data on the iodine content of Swiss common salt, bromides, drinking and river water, air, snow, coal, ashes, soot, and food materials of vegetable and animal origin.

**Preparation and properties of colloidal arsenate of lead**, F. J. BRINLEY (*Jour. Agr. Research* [U. S.], 26 (1923), No. 8, pp. 373, 374).—A satisfactory colloidal lead arsenate has been prepared at the Bureau of Entomology, U. S. D. A., as follows:

To 311.96 gm. of crystallized disodium arsenate is added 17.35 gm. of gelatin and the mixture is dissolved in hot water and diluted to 10 liters. A solution of lead nitrate is prepared by dissolving 331.4 gm. of the salt in hot water and making up to 10 liters. The two solutions are mixed by pouring the solution of lead nitrate into the solution of sodium arsenate and gelatin, with constant stirring. The mixture should be tested occasionally with potassium iodide test paper to determine when the lead salt is slightly in excess, as a large excess should be avoided.



The amounts given above represent  $\frac{1}{10}$  molar concentrations which have been found to give a true colloidal solution, which will pass through filter paper and remain in suspension several days and which, when sprayed upon the leaf, forms a thin, closely adhering film.

The amounts required to make approximately 1 lb. of lead arsenate are 14.03 oz. of disodium arsenate, 14.91 oz. of lead nitrate, and 1 oz. of gelatin, each salt being diluted to make 3.5 gal.

**The distribution of calcium and of inorganic phosphorus in milk,** P. GYÖRGY (*Biochem. Ztschr.*, 142 (1923), No. 1-2, pp. 1-10).—By ultrafiltration and by analysis of whey the content of indiffusible phosphorus in human and cow's milk was determined.

In cow's milk the undialyzable inorganic phosphorus amounted to from 50 to 60 per cent and in human milk from 30 to 40 per cent of the total phosphates. Acidification of the milk led to an increase in the amount of diffusible calcium and phosphorus, both in cow's milk and human milk. At the isoelectric point of casein the total amount of calcium and phosphorus was freely dissolved.

Tryptic digestion of the milk at constant H-ion concentration also led to an increase in diffusible calcium and phosphorus. Similar results were obtained with casein enriched by calcium phosphate and subjected to tryptic digestion.

The author concludes that there exists a close affinity between the casein and the indiffusible calcium phosphate of the milk.

**Compounds developed in rancid fats, with observations on the mechanism of their formation,** W. C. POWICK (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 8, pp. 323-362, figs. 2).—This is the second of a series of studies conducted at the Bureau of Animal Industry, U. S. D. A., on rancidity, the first of which by Emery and Henley has been noted (*E. S. R.*, 48, p. 414).

On the basis that oleic acid is the substance attacked in the development of rancidity in fats, a systematic examination was first made of the known degradation products of oleic acid as to odor and behavior with the Kreis phloroglucin-hydrochloric acid reagent. Negative results were obtained in the Kreis test with all the compounds examined, which included hydroxystearic, dihydroxystearic, ketoxystearic, diketostearic, azelaic, pelargonic, caprylic, heptylic, caproic, butyric, formic, and acetic acids, nonylic, heptylic, and butyric aldehydes, acetaldehyde, formaldehyde, and azelaic half aldehyde. None of these substances, with the exception of nonylic and heptylic aldehydes, had odors characteristic of rancid fats.

It was found that the typical rancid condition could be reproduced in all essential respects by the atmospheric oxidation of pure oleic acid and the hydrolysis of the oleic acid ozonid thus formed.

A preliminary examination of the unsaturated aldehydes for the Kreis test gave negative results for acrolein but an intense red color with acrolein treated with hydrogen peroxid. Crotonic aldehyde gave inconclusive results. Spectroscopically the color obtained in the Kreis test on rancid fats was identical with that obtained with the product formed by the action of hydrogen peroxid on acrolein and different from the similar color obtained with various nonrancid substances. An examination of the substance formed from acrolein and hydrogen peroxid led to the conclusion that it is epihydrin aldehyde. On account of its instability it has not been isolated but its diethylacetal,  $\text{CH}_2\text{CH}(\text{OC}_2\text{H}_5)_2$ , has been synthesized. While it is thought that the constituent of rancid fats responsible for the Kreis test is not free epihydrin aldehyde, it is considered certain that it gives rise to epihydrin aldehyde when the fat containing it is brought into contact with the concentrated hydrochloric acid used in the test.

A mechanism has been suggested to explain the formation of epihydrin aldehyde in the atmospheric oxidation of oleic acid. This also brings in the

formation of heptylic aldehyde and other aldehydes which have been isolated from rancid fats.

Attention is called to the fact that the Kreis test as usually performed is not always a reliable indication of rancidity in fats, and that for reliable results the color should be examined spectroscopically.

A list of 46 references is appended.

**On the catalytic hydrogenation of certain oils**, L. KAHLENBERG and T. P. PI (*Jour. Phys. Chem.*, 28 (1924), No. 1, pp. 59-70, figs. 2).—Data are reported on the hydrogenation of cottonseed oil and soy bean oil, using various catalysts, and of various other oils and fatty acids with nickel silicate as catalyst. The criteria for the success of the hydrogenation were the iodine number and melting point of the hardened fats.

Of the 15 catalysts used with cottonseed oil, nickel silicate proved most satisfactory. The optimum temperature for the reduction of this catalyst was from 290 to 300° C. and for the hydrogenation of the oil from 180 to 200°. Nickel tungstate was efficient as a catalyzer except that a rather high temperature was required for its reduction. Soy bean oil was successfully hydrogenated by nickel chromate and nickel manganate. Olive oil was hardened in two hours with nickel silicate as a catalyzer, but it proved impossible to obtain a solid product from corn oil, neat's-foot oil, or fish oil. The hydrogenation of free fatty acids was accomplished much more readily than of the corresponding oils. This was particularly true of neat's-foot oil.

**Analysis of peanut butter**, R. O. BAIRD (*N. Dak. State Food Commr. and Chem. Bul.* 3 (1923), pp. 1-3).—Data are reported on the refractive index and iodine number of 15 samples of peanut oil and on the composition of peanut butters of the same brands. The minimum and maximum figures reported are as follows: For peanut oil, refractive index at 25° C. 1.4668 and 1.4696, and iodine number 84.1 and 95.7; for peanut butter, moisture 1.21 and 2.54 per cent, ash 2.09 and 3.4, crude fiber 1.54 and 2.31, crude fat 43.38 and 55.30, protein (N×6.25) 29.93 and 34.05, and nitrogen-free extract 7.22 and 17.82 per cent, respectively. Minimum and maximum values for calories per pound and calories per 25 cts. are 2,744 and 3,053 and 1.176 and 4.241, respectively.

**A chemical analysis of *Jatropha stimulos***, P. MENAUL (*Jour. Agr. Research* [U. S.], 26 (1923), No. 6, pp. 259, 260).—Analyses are reported of the seeds of spurge nettle (*J. stimulos*) and of the oil obtained from them by pressure.

The seeds, which resemble those of the castor bean, were found to consist of 39 per cent hull and 61 per cent kernel. The kernel had the following composition: Water 1.58 per cent, ash 3.50, protein 33.3, fiber 2.9, nitrogen-free extract 7.81, and fat 50.91 per cent.

The oil extracted by pressure from the kernels was of a clear yellowish color and a mild and pleasant taste. The constants obtained for the oil were as follows: Specific gravity 0.9257 at 15.6° C., refractive index 1.4765 at 15.6°, solidifying point below -15°, iodine number 124.65 to 129.47, saponification number 186.4 to 186.56, volatile fatty acids none, free fatty acids trace, fatty acids 95.6 per cent, and glycerin (about) 4.2 per cent.

From the ether-extracted meal 24.2 per cent of the total protein was obtained by extraction with 5 per cent NaCl, 32.68 per cent by 10 per cent NaCl, 12.11 per cent by 15 per cent NaCl, 73.3 per cent by 2.5 per cent HCl, and 78.72 per cent by 2 per cent Na<sub>2</sub>CO<sub>3</sub>. Analyses of the protein prepared by extraction with 10 per cent NaCl and by 0.2 per cent NaOH, followed by precipitation with acid according to the method of Dowell and Menaul (*E. S. R.*, 45, p. 717), gave the following results: Amid N 11.27 and 11 per cent, humin N 2.11 and 2.36, cystin N trace and trace, arginin N 14.4 and 14.39,



histidin N 12.4 and 12.61, lysin N 4.61 and 4.5, and total N of amino acids 55.33 and 54.76 per cent, respectively.

**The amino acids of zein,** H. D. DAKIN (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 130 (1923), No. 1-6, pp. 159-168).—The author has analyzed the hydrolysis products of zein by the butyl alcohol extraction method (E. S. R., 40, p. 611) with the following results: Alanin 3.8, valin 0, leucin 25, isoleucin 0, phenylalanin 7.6, tyrosin 5.2, prolin 8.9, oxyprolin 0, asparagin 1.8, glutaminic acid 31.3,  $\beta$ -oxyglutaminic acid 2.5, and tryptophan 0 per cent. These results are compared with values previously reported by other observers. It is noted that the highest figures reported from the various analyses total 101.5 per cent, which is thought to indicate that all of the amino acids of zein have been identified.

**Effect of amino acids in retarding the hydrolytic decomposition of an enzym (pancreatic amylase),** H. C. SHERMAN and F. WALKER (*Jour. Amer. Chem. Soc.*, 45 (1923), No. 8, pp. 1960-1964).—In this further study of the favorable effect of amino acids upon the enzymic hydrolysis of starch, as noted in previous studies (E. S. R., 46, p. 707), three methods of investigation were used: "(1) The resulting losses in activity of equal portions of the same enzym solution were compared after these portions had stood in absence of substrate for a definite length of time at known temperatures, alanin having been added to some portions while others contained no amino acid; (2) the effect of temperature upon 'activation' due to amino acids was determined; and (3) a similar series of experiments was carried out in which the enzym was allowed to act at these different temperatures for a longer time."

The results obtained confirm the previous conclusion that the favorable influence of amino acids is due at least in part to the fact that they retard the deterioration of the amylase in water solutions. Solutions of pancreatic amylase containing the optimum concentration of sodium chlorid and phosphate on analysis, after standing for one hour at 40° C., showed one-third greater amylolytic activity than similar solutions to which alanin had not been added.

In the study of the effect of variation of temperature, glycin and phenylalanin were used as the protective amino acids, and a series of 30- and 60-minute digestions were run at temperatures varying from 30 to 75°. For the 30-minute digestion, beginning with an increase at 30° of 14 per cent of cuprous oxid, a maximum of 100 per cent was reached at 60°, above which temperature the effect declined rapidly, probably due to coagulation of the amylase at the higher temperature. The same was true to a less extent with phenylalanin. In the 60-minute digestion a greater apparent activation at all temperatures up to that of the coagulation of the enzym occurred than in the 30-minute digestion. "That the presence of amino acids retards the hydrolytic destruction of the enzym constitutes, as we have previously pointed out, an interesting addition to the evidence supporting the view that the enzym itself is a substance of protein nature or one which contains protein as an essential constituent."

**The chemistry of insulin,** N. EVERS (*Chem. Age [London]*, 9 (1923), No. 229, pp. 478-480).—This is a concise summary of the history of the discovery of insulin and of its commercial preparation, physiological effects, and chemical properties.

**Concentration of insulin by adsorption on benzoic acid,** P. J. MOLONEY and D. M. FINDLAY (*Jour. Biol. Chem.*, 57 (1923), No. 2, pp. 359-361).—A method is described for the purification of crude insulin by adsorption on benzoic acid. The method consists essentially in adding a dilute solution of sodium benzoate to an impure aqueous solution of insulin and acidifying the mixture. The benzoic acid is precipitated in a finely divided state and carries down with

it the greater part of the potent material, which can be recovered in aqueous solution from the precipitate in various ways. If the original solution is comparatively free from protein, the precipitate is treated directly with ether and water, the former dissolving the benzoic acid and the latter the insulin. If many impurities are present the moist precipitate is treated with 80 per cent ethyl alcohol, which dissolves both the insulin and the benzoic acid. After the impurities have been removed by filtration the ether treatment is carried out as before.

**Industrial filtration**, A. WRIGHT (*New York: Chem. Catalog Co., Inc., 1923, pp. 336, figs. 135*).—This is the first of a series of volumes by different authors on various fundamental processes in chemical engineering, the series as a whole to be known as the Modern Library of Chemical Engineering. The present volume deals with the theory and mechanics of filtration and filter practice. The discussion of each filter includes the development, operation, and drawbacks, and the advantages which explain its basis of application to certain work.

**Apparatus for micro-ultrafiltration**, A. THIESSEN (*Biochem. Ztschr., 140 (1923), No. 4-6, pp. 457-460, fig. 1*).—This apparatus for the ultrafiltration of very small amounts of material embodies the principles of the ultrafiltration apparatus of Zsigmondy, with the modifications of Jander (*E. S. R., 48, p. 502*).

**A simple micropipette holder**, H. W. JOHNSON (*Jour. Bact., 8 (1923), No. 6, pp. 573-575, fig. 1*).—This contribution from the Iowa Experiment Station consists of a description, with illustrative diagram, of a simple micropipette holder.

**A quantitative method for the determination of total sulphur in biological material**, M. STOCKHOLM and F. C. KOCH (*Jour. Amer. Chem. Soc., 45 (1923), No. 8, pp. 1953-1959*).—A new wet oxidation method of determining sulphur in biological materials is described, and the results are reported of sulphur determinations by the regular fusion method and the new perhydrol method in cystin of known sulphur content, four samples of fat-free dried tissue, sulpholipin from brain tissue, air-dried egg yolk, and crude bile salts.

The technique of the new method is essentially as follows: From 0.5 to 2 gm. of the substance is placed in a 100 cc. nickel crucible containing 10 cc. of 25 per cent sodium hydroxid solution. The crucible is covered and heated on the steam bath until nearly dry, which requires several hours. To the slightly moist material 5 cc. of perhydrol (30 per cent hydrogen peroxid) is added very gradually without the removal of the crucible from the steam bath. The partly oxidized material is next transferred to a 300 cc. flask, acidified with nitric acid, and heated over a free flame until salts begin to separate. Fuming nitric acid and bromin are added gradually to the boiling solution to the extent of 10 cc. of the acid and from 40 to 50 drops of the bromin. After evaporating the solution to dryness water is added and the evaporation repeated. The solution is filtered, neutralized with sodium hydroxid, diluted to about 600 cc., and acidified by the addition of 10 cc. of concentrated hydrochloric acid. Ten cc. of  $\pi/10$  sulphuric acid is added and the method continued as in the ordinary fusion method.

The new perhydrol method gave calculated values for cystin and more uniform and generally higher results for the other materials than were obtained by the fusion method. The low and irregular results obtained by the dry fusion method are attributed to loss of reduced sulphur by volatilization.

**The determination of phosphorus in organic materials**, J. GAROLA (*Ann. Chim. Analyt., 2. ser., 5 (1923), No. 11, pp. 326-328*).—To avoid loss of phosphorus by volatilization during ashing, the author suggests the addition of



calcined magnesia to the material to be ashed, and presents data showing that the process yields accurate results.

**The decomposition of organic substances and the colorimetric determination of small amounts of metals,** K. K. JÄRVINEN (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 45 (1923), No. 4, pp. 183-190).—Detailed directions are given for the oxidation of food materials with sulphuric and nitric acids in such a way as to avoid loss of volatile metals and for the colorimetric determination in the oxidized material of zinc and lead, copper and zinc, aluminum, nickel, arsenic, and antimony.

**Lead studies.—VIII, The microchemical detection of lead,** L. T. FAIRHALL (*Jour. Biol. Chem.*, 57 (1923), No. 2, pp. 455-461, figs. 3).—The method described, which has been developed for use in the detection of minute amounts of lead when only qualitative results are desired and as a confirmatory test in connection with the quantitative determination by such methods as described in a previous paper of the series (E. S. R., 49, p. 113), is a modification of the so-called triple nitrite test of Behrens and Kley. This test as originally described consists in adding small crystals of copper acetate, sodium acetate, and potassium nitrite successively to a drop of the lead-containing solution which has been slightly acidified with acetic acid. The hexanitrite crystallizes in regular rectangular plates or cubes. In the technique as outlined the procedure has been made more definite by the use of measured quantities of solutions of the salts of definite concentration. It is said that by means of this method quantities as small as 1  $\mu$  of lead may be separated and identified in the presence of a considerable amount of other inorganic salts.

**The so-called auto-oxidation of cystein,** S. SAKUMA (*Biochem. Ztschr.*, 142 (1923), No. 1-2, pp. 68-78, figs. 4).—The author is of the opinion that the so-called auto-oxidation of cystein is due to the presence in the cystein of minute amounts of iron acting as catalyst. Evidence is presented that if cystein and the reagents used in the test are carefully purified, the oxidation reaction proceeds at a much slower rate. It is thought that use can be made of this fact to determine amounts of iron too small to be detected by ordinary methods of chemical analysis.

**The iodometric determination of aldoses,** J. M. KOLTHOFF (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 45 (1923), No. 3, pp. 131-141; also in *Pharm. Weekbl.*, 60 (1923), No. 14, pp. 362-375).—A review of the literature on the iodometric determination of aldoses is presented, together with the report of an examination of the various techniques recommended.

It is concluded that aldoses can be determined with hypiodite, using either sodium hydroxid or sodium carbonate as the alkaline reagent. If sodium hydroxid is used the neutral sugar solution should be treated with at least twice the theoretical requirement of the iodine solution and with at least the same excess of sodium hydroxid. After from 5 to 10 minutes, the longer time in the case of lactose, the mixture is acidified and titrated with the thiosulphate solution. In the sodium carbonate method the same excess of the iodine is added, followed by 15 cc. of 2N sodium carbonate solution. After from 20 to 30 minutes the solution is acidified with 10 cc. of 4N sulphuric or hydrochloric acid and then titrated with thiosulphate.

In the titration of glucose in invert sugar, a 1 per cent correction should be applied for the influence of fructose on the reading. For the determination of considerable sucrose in the presence of lactose, the sodium carbonate method is to be preferred to the sodium hydroxid method.

**The application of the iodometric method of determining aldoses to the analysis of carbohydrate-containing mixtures,** J. M. KOLTHOFF (*Ztschr.*

*Untersuch. Nahr. u. Genussmtl.*, 45 (1923), No. 3, pp. 141-147; also in *Pharm. Weekbl.*, 60 (1923), No. 15, pp. 394-402).—For determining single aldoses by the iodometric method in the presence of other carbohydrates, the following directions are given:

For the determination of lactose in milk 5 cc. of the milk serum is treated with 25 cc. of N/10 iodine solution and 15 cc. of 2N sodium carbonate solution. After 25 minutes the mixture is acidified with 10 cc. of 4N HCl or H<sub>2</sub>SO<sub>4</sub> and titrated with N/10 thiosulphate solution, 1 cc. of which is equivalent to 18 mg. of lactose hydrate.

To determine fructose in the presence of glucose, a suitable amount of the solution is treated with iodine and sodium hydroxide to oxidize the glucose. After 5 minutes the solution is acidified and the excess iodine taken up by a 10 per cent sodium sulphite solution until it is light yellow in color, when the neutralization is finished with a 1 per cent solution. The solution is then filtered and the fructose is determined in 25 cc. of the filtrate by the method of Schoorl.

If glucose, fructose, and sucrose are present in the same solution, glucose is first determined iodometrically. The sum of the glucose and fructose is then determined with an alkaline copper solution, or the fructose is determined in a separate portion of the solution by the above method. Sucrose is determined after inversion with N/50 HCl.

In starch sirup glucose, fructose, and sucrose are determined as described above, and dextrin is determined in a portion of the original solution by hydrolysis with 50 per cent base, the difference between the values for glucose obtained by the strong and the weak inversion being considered as dextrin. For the determination of lactose in the presence of much sucrose, the carbonate method is recommended in preference to the hydroxide method.

**Further contribution to the determination of fat in foods and soaps**, J. GROSSFELD (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 45 (1923), No. 3, pp. 147-152).—Slight modifications in the technique of the chloroethylene method of determining fat in food materials and soaps (E. S. R., 48, p. 805) are outlined.

The extraction of the fat can in many cases be conducted in the cold. Filtration difficulties can be lessened by the addition of gypsum, and turbidity in the water phase avoided by shaking with a little kieselguhr. The fat solution can be distilled over a free flame instead of on the water bath.

**A method for the quantitative estimation of tannin in plant tissue**, P. MENAUL (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 6, pp. 257, 258).—The colorimetric method described was developed at the Oklahoma Experiment Station for the estimation of tannin in grain sorghums. The color reagent is prepared by boiling 100 gm. of sodium tungstate and 30 gm. of pure arsenic pentoxide with 300 cc. of water and 50 cc. of concentrated hydrochloric acid for two or three hours under a reflux condenser, cooling the solution and diluting it to 1 liter. The solution as thus prepared is sensitive to many reducing agents and must be kept away from hydrogen sulphide and other reducing agents.

The sample to be tested is first ground to pass a No. 40-mesh sieve and extracted as described by Fuller (E. S. R., 45, p. 207). To 10 cc. of the filtrate in a urine centrifuge tube is added 2 cc. of a 10 per cent solution of lead acetate. The tube is placed in water at 75° C. until the precipitate coagulates, after which it is centrifuged for three minutes, the supernatant liquid poured off, and the precipitate drained as completely as possible. From 5 to 10 drops of 5 per cent sulphuric acid is then mixed with the residue, water is added to almost fill the tube, and the tube is centrifuged for three minutes. The supernatant liquid is transferred to a 50 or 100 cc. volumetric flask. At the



same time a similar flask is prepared containing 1 or 2 mg. of pure gallotannic acid from which the gallic acid has been extracted with ether. To each flask are added 2 cc. of the color reagent, 10 cc. of a 20 per cent solution of sodium carbonate, and sufficient water to bring the contents to volume. After standing for five minutes the colors are compared.

The amounts of tannin in various sorgos and sorghums determined by the above method were found to be as follows: Dawn kafir 0.06 per cent, darso 0.4, White kafir trace, hegari 0.15, Black Amber sorgo 0.2, African millet 0.27, Club Head sorgo 0.16, Orange sorgo 0.5, broomcorn 0.4 per cent, Yellow milo trace, and White milo none.

**Determination of amino acids by electrometric titration**, E. M. P. WIDMARK and E. L. LARSSON (*Biochem. Ztschr.*, 140 (1923), No. 1-3, pp. 284-294, figs. 8).—Data are given on the electrometric titration of various amino acids with sodium hydroxid of varying normality. It was found possible to obtain results conforming closely to the theoretical except in the case of arginin.

**A study of the inorganic elements of blood plasma**, A. P. BRIGGS (*Jour. Biol. Chem.*, 57 (1923), No. 2, pp. 351-357).—A system of analysis is outlined for the determination of sodium, potassium, magnesium, chlorids, and phosphates in from 9 to 15 cc. of blood plasma. Of particular interest in the scheme of analysis as presented are the use of lithium citrate as an anticoagulant and the use of a new method for determining potassium. The latter is a hitherto unpublished method developed by Doisy and Bell, and depends upon the nitrite color reaction of Griess to determine the nitrite precipitated with potassium as potassium cobalti-nitrite. The technique of the method is described in detail, together with an outline of the procedure for the determination of the other elements.

**Sugar progress since 1912**, G. BARTSCH (*Ztschr. Angew. Chem.*, 36 (1923), Nos. 66, pp. 489-492; 69, pp. 536-539).—This is a brief discussion of improvements effected in the past 10 or 11 years in the cultivation of sugar beets and sugar cane and in the processes of manufacturing beet sugar and cane sugar.

**Neutral clarification, its determination, and its effect on the lime content of the clarified juice**, A. H. ALLEN (*Internatl. Sugar Jour.*, 25 (1923), No. 299, pp. 587-590).—Essentially noted from another source (*E. S. R.*, 50, p. 413).

**Water glass—a bibliography**, compiled by M. SCHRERO (*Pittsburgh: Carnegie Libr.*, 1922, pp. 83).—The references in this bibliography are classified under the headings of patent literature, history, general, properties, manufacture, and applications. Over 40 references are given to the use of water glass in the preservation of eggs.

## METEOROLOGY.

**Weather conditions unfavorable to agriculture in the United States**, F. TERMER (*Wetterschäden und Landwirtschaft in den Vereinigten Staaten von Amerika. Halle: Max Niemeyer, 1923, pp. 79*).—This monograph, published by the Institut für Amerikaforschung of the University of Würzburg, was written primarily for the information of German emigrants to America. It reviews briefly modern progress of investigations in agricultural meteorology and climatology; gives a brief description of the climates of the United States, with special reference to agriculture; classifies and describes the climatic conditions injurious to crops under temperature (cold waves, frost, hot waves), precipitation (amounts and types of rainfall, droughts, floods, hail, thunderstorms), and wind (northers, chinook, tornadoes); and explains the geographical distribution of the injurious phenomena with reference to climatic districts and

individual crops, the latter being based on Valgren's data (E. S. R., 46, p. 787) for average annual damage to staple crops, stated in percentages of the normal yields during the 10-year period 1909-1918. The injurious phenomena are stated in the order of their importance for each crop. ▲ list of 75 references to literature cited is given.

**Can we control the weather?** C. F. TALMAN (*Outlook*, 133 (1923), No. 11, pp. 493-495, figs. 2; also in *Tycos*, 14 (1924), No. 1, pp. 23-25).—The present status and possibilities of weather control are briefly reviewed, the author observing in conclusion that the fact that "most large-scale undertakings in weather-making have been fostered by ignorance and superstition, and were therefore foredoomed to failure, is no reason why first-rate scientific ability should not employ itself in this field. The rewards to be gained are stupendously great, and the possibilities of the future are almost boundless."

**The weather in 1924**, H. J. BROWNE (*Country Gent.*, 89 (1924), No. 1, p. 1).—The author attempts in this brief article to forecast the weather for 1924 in the United States generally and by sections and to tell how these conclusions are reached. "Taking the country as a whole the temperature for 1924 will be below the average and the rainfall likewise. It will be a 'cold-dry' year, according to the standard of the eminent meteorologist, Brückner."

**Phenological contributions, 1922**, E. IHNE (*Arb. Landw. Kammer Hesse*, No. 32 (1923), pp. 36).—This is a record of observations, uniform with those of previous years, at 30 stations in Hesse and 41 in the rest of Germany, 6 in Austria, 2 in Switzerland, and 1 each in Hungary, the Netherlands, and England. Recent phenological literature is also noted and the stations at which observations have been made for a series of years are listed. The author states that the publication of this, the fortieth annual report on this series of observations, was made possible by the financial assistance of A. D. Hopkins, who expressed the opinion that discontinuance of the reports would be "a great loss to phenology and bioclimatics."

**Effect of wind direction on temperature and humidity at Jerusalem**, S. KRICHEWSKY (*Egypt Min. Pub. Works, Phys. Dept. Paper 10* (1923), pp. 9-15).—It is pointed out that "the connection between wind direction and weather . . . is of peculiar interest with regard to Palestine. Since Biblical times there is a quite definite tradition about the qualities of the winds from the cardinal points in that country, and modern writers describe the well-marked influence of the changes in the wind direction on weather, animal life, and agriculture in Palestine essentially in the same way as do some weather sayings in the Bible." A summary of observations at Jerusalem, 1896-1913, however, shows that tradition can be accepted only with certain important qualifications. For example, north winds are infrequent and are cold only in winter; south winds are still more infrequent and are warm particularly in the spring; east winds are hot and usually but not always dry; west winds (sea winds) are the most frequent and beneficent. The latter "are the source of supply for the rainfall and the dew of this country; they mitigate its climate in rendering the winter less severe and the summer cooler."

**Rainfall map of Australia for the year 1922**, H. A. HUNT ([*Melbourne*]: *Govt.*, 1923; rev. in *Nature* [London], 112 (1923), No. 2817, p. 634).—This rainfall map, issued by the Commonwealth meteorologist, shows the annual and monthly rainfall for 1922, as well as the distribution of rainfall above the average in every year since 1908. The rainfall of the year was above the average over 21 per cent of the area of the country, but was the lowest on record in several places, the pastoral areas suffering most severely.



## SOILS—FERTILIZERS.

**Common earthenware jars a source of error in pot experiments, J. S. McHARGUE** (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 5, pp. 231, 232, pl. 1).—In a contribution from the Kentucky Experiment Station data are presented which indicate that earthenware pots, of the grade in common use in pot experiments, may be sufficiently porous to absorb enough plant nutrients during one experiment to affect the growth of other plants grown in the same pots in later experiments. Acid-proof stoneware is recommended for use in exact work of this nature.

**Soil profile studies in Michigan, M. M. McCool, J. O. Veatch, and C. H. Spurway** (*Soil Sci.*, 16 (1923), No. 2, pp. 95-106).—Field and laboratory studies of Michigan soils, conducted at the Michigan Experiment Station and made on the basis of soil profiles, including the whole thickness upon which the soil-forming processes have operated from the surface down to the geologic substratum, are reported, and the preliminary results obtained during the year 1922 are discussed. The primary purpose of this work was to ascertain chemical and physical facts regarding the soils, to determine whether basic chemical and physical constitutional differences exist between separate members or horizons of the soil profile, and to what extent the visible phenomena in the field can be correlated with laboratory data.

The laboratory investigations, as far as they have progressed, are considered to point to fairly consistent physical and chemical differences for the separate horizons as they have been interpreted in field studies. The authors believe that such profile studies constitute a step forward in soil science.

**Soil survey of Geneva County, Ala., A. H. Meyer et al.** (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1920, pp. III+287-314, fig. 1, map 1).—This survey, made in cooperation with the Alabama Department of Agriculture and Industries, deals with the soils of an area of 369,920 acres lying entirely within the Coastal Plain province in southeastern Alabama. The topography ranges from almost flat to steeply rolling. As a whole, the county is said to be fairly well drained.

The soils of the county are derived mainly from unconsolidated sand and clay of the Coastal Plain deposits. They are prevallingly light in color, ranging from extensive areas of light gray or yellowish gray soils to comparatively small areas of red soils. All these soils are said to be dominantly low in organic matter and characteristically free from carbonates. Including swamp, 16 soil types of 9 series are mapped, of which the Norfolk sandy loam and loamy sand cover 30.1 and 13.3 per cent of the area, respectively.

**Soil survey of Woodbury County, Iowa, J. O. Veatch et al.** (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1920, pp. III+759-784, fig. 1, map 1).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 561,280 acres situated in the western part of the Upper Mississippi Plains region in western Iowa. Topographically, the area consists of an upland plain, a broad level alluvial plain, and the Missouri River bluffs. The upland plain is everywhere well drained naturally, but is not subject to serious soil erosion except in the steepest slopes, such eroded land constituting only a very small percentage of the total. The bottom land is level, and the greater part of the heavy soils requires artificial drainage.

The soils of the area are of fine texture, silt and clay predominating. Including undifferentiated alluvial soils, 18 soil types of 9 series are mapped, of which the Marshall silt loam covers 58.4 per cent of the area.

**Soil survey of Lafayette County, Mo., W. De Young and H. V. Jordan** (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1920, pp. III+813-837,

*fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 391,680 acres lying in the prairie region in west-central Missouri. The topography is smooth to rolling, the greater part being gently rolling. Some of the bottom lands bordering streams in the county are said to be poorly drained.

The area is said to be mainly a region of dark colored prairie soils. These are grouped as loessial, residual, old alluvial, and recent alluvial types. Including riverwash, 20 soil types of 13 series are mapped, of which the Marshall, Boone, Summit, and Pettis silt loams cover 26.1, 15.6, 14.6, and 10.3 per cent of the area, respectively.

**Soil survey of Buncombe County, N. C.**, S. O. PERKINS ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+785-812, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture and Experiment Station, deals with the soils of an area of 391,680 acres lying in a broad intermountain plateau in western North Carolina. The topography is rolling to hilly, and only a few small areas of flat bottom land are poorly drained.

The soils of the area are prevailing brown to reddish brown, although there are some noticeable areas of gray to grayish brown soils, and also a few areas of black soils. The dominant textures of these soils are loams and clay loams with small areas of fine sandy loam. A common characteristic is the absence of free carbonates.

Including rough stony land, rock outcrop, and meadow, 21 soil types of 11 series are mapped, of which Porters stony loam, Cecil clay loam, and Cecil loam cover 22.2, 21.8, and 17 per cent of the area, respectively.

**Determination and valuation of the colloids in soil**, R. WACHE (*Mitt. Lab. Preuss. Geol. Landesanst. No. 2 (1921), pp. 32*).—A detailed review of the works of others bearing on the subject is followed by a report of studies by the author on the influence of soil reaction on hygroscopicity and the determination of colloids in soils.

The results showed that the height of hygroscopicity, which with constant colloid content varies with the absorptive saturation of the colloids, can not in itself serve as a measure of productivity of soil. However, the height of hygroscopicity apparently can be used with certain limitations for the quantitative determination of colloids in soil. This factor can be effective in the manner noted only in soils which contain different amounts of colloids but in which exists a constant degree of absorptive saturation. Earlier results indicating a definite influence of hygroscopicity or of surface area of the soil constituents upon crop yields, are attributed to a constant degree of saturation of the soil colloids.

**A note on the relation between H-ion concentration and physical properties of soil**, O. ARRHENIUS (*Geol. För. Stockholm Förhandl., 44 (1922), No. 6-7, pp. 745-749, figs. 3; abs. in Chem. Abs., 17 (1923), No. 12, p. 2160*).—Studies in which the hygroscopicity, fineness, and water capacity of soil were compared with the settling rate and height of the precipitated column of the clay suspension at varying H-ion concentrations are reported.

The results showed that a high settling rate, maximum fineness, and high clay column occurred at high alkalinity and acidity and at the isoelectric point. The hygroscopicity, on the other hand, was low at those points, but high when the clay was more stabilized. These results are taken to indicate that hygroscopicity and fineness, as well as the settling rate at different reactions, support the hypothesis that the clay is an amphotelyte.

**A note on soil reaction studies**, P. E. KARRAKER (*Soil Sci., 15 (1923), No. 6, pp. 473-478*).—In a contribution from the Kentucky Experiment Station, data



on the lime requirements determined by the Veitch and Hopkins methods and the H-ion concentration determined by the electrometric and colorimetric methods of samples of soil collected from a number of the soil fertility experimental fields in the State are presented and discussed, in connection with the yields of red clover in the field in the case of experimental field plats and with the nature of the sweet clover growth indicated in the sweet clover study samples. While no conclusions are drawn, the close correlation between limestone treatment or the presence of limestone material in soil and H-ion concentration is noted.

**The litmus method for detecting the soil reaction,** E. A. CARLETON (*Soil Sci.*, 16 (1923), No. 2, pp. 91-94).—Studies conducted at Macdonald College with solutions and soils showed that the effectiveness of the litmus paper test for soil reaction depends upon the H-ion concentration of the soil. The three shades of color assumed by blue litmus paper in contact with 22 soils, varying widely in color and other physical characteristics, were, roughly, pink, slightly pink, and very slightly pink, with respective pH ranges of from 4.8 to 5.2, from 5.2 to 5.8, and from 5.8 to 6.7. It is further pointed out that the changing of color of red litmus does not mean that a soil is basic unless the proper blue color is imparted to the paper.

**Acidity of highly basic soils,** W. T. McGEORGE (*Soil Sci.*, 16 (1923), No. 3, pp. 195-206).—In a contribution from the experiment station of the Hawaiian Sugar Planters' Association, the results of soil acidity determinations by 13 different methods of soils containing large amounts of oxides of iron and aluminum are reported and discussed, the purpose being to interpret the nature of the acidity of island soils.

It was found that in the humid districts organic matter with an acid reaction is an important cause of soil acidity, while in sections of low rainfall this is true to a far less extent. Mineral acidity was found to be due mainly to aluminum salts and aluminum silicates, the latter predominating in the humid districts. Iron was found to be a factor only in the very acid soils with reactions of pH 4 to 6, while manganese was a factor only in those soils with pH values of from 5.5 to 7. Water of combination or hydration was also an important factor of soil acidity in all types of soil studied.

**Subsoil acidity,** A. P. KELLEY (*Science*, 58 (1923), No. 1489, p. 36).—In a contribution from the University of Pennsylvania, H-ion concentration determinations of over 500 samples of soils from wooded areas in southeastern Pennsylvania taken at a depth of 300 cm. (12 in.) are briefly reported. In all cases there was an increase in acidity with depth to 15 or 30 cm., then a gradual decrease toward neutrality. The extent of this variation seemed to be correlated with the productiveness of the soil, being least in the fertile Hagerstown loam.

**Conditions of solubility of soil nutrients and their importance in fertilization,** ENGELS (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 4, *Wirtschaft.-Prakt.*, pp. 185-209).—Studies on the determination of the availability to plants of soil nutrients, particularly phosphoric acid, by means of dilute acids and by physical and other processes are reported.

The results are taken to indicate that neither by the use of chemical analyses of the soil and plant nor by the use of other common methods, with the exception perhaps of field cropping experiments, can the quantity of easily available nutrient material in soil be accurately determined. It is concluded, however, that the determination of the relative solubility of phosphoric acid and potassium in soil by the use of 1 per cent citric acid or 10 per cent hydrochloric acid closely approaches the solution of the question.

**The occurrence and action of fungi in soils**, E. V. ABBOTT (*Soil Sci.*, 16 (1923), No. 3, pp. 207-216).—Studies conducted at the Iowa Experiment Station on certain activities of various fungi in soils, especially in relation to sulphur and phosphorus, are reported.

Twenty-eight species of fungi representing 12 genera were isolated from 5 soils which varied in lime requirement from 0 to 5 tons per acre. The organisms isolated included the common soil genera, but represented a small proportion of the total soil flora. The Waksman and Fred synthetic acid medium proved to be the most satisfactory for isolating fungi, since bacterial development was depressed on this medium.

With two exceptions, the organisms tested produced rather vigorous ammonification. The members of the imperfect genera exhibited the greatest ammonifying ability, while members of the genus *Penicillium* were the weakest in this respect. All of the species tested ammonified cottonseed meal more readily than dried blood, with the single exception of *Acrostalagmus albus*.

Five species, *Aspergillus fumigatus*, *A. flavus*, *P. funiculosum*, *P. luteum*, and *Cladosporium herbarum*, had the ability to liberate soluble phosphorus from raw rock phosphate. *P. luteum* was the only organism tested which was able to oxidize free sulphur to a sulphate form. Seven strains of this organism showed about the same oxidizing powers.

With composts of sulphur and raw rock phosphate, only three organisms, *A. koningi*, *P. funiculosum*, and *Mucor glomerula*, showed consistent gains in the amounts of citrate soluble phosphorus liberated through successive incubation periods of 15 days. With few exceptions, the remaining species showed a decrease under the check in 15 days and an increase in 20 days, followed by a marked decrease in 45 days. It is considered probable that these variations correspond with the development of successive generations of these organisms.

**Partial sterilization of soil, microbiological activities, and soil fertility**, I, S. A. WAKSMAN and R. L. STARKEY (*Soil Sci.*, 16 (1923), No. 3, pp. 137-157, figs. 4).—The results of studies conducted at the New Jersey Experiment Stations on the influence of toluene and heat upon the microbiological population of variously treated soils are reported.

Both these factors were found to influence markedly not only the development of bacteria and protozoa in the soil, but also that of the Actinomycetes and especially of the fungi. The fungi were repressed very markedly but soon began to develop, especially when reintroduced, and reached numbers greatly in excess of those in the untreated soil. The fungi developing in the partially sterilized soils were limited to only a few species.

Ammonia accumulations in the partially sterilized soils were greater than those in the untreated soils, especially in soils rich in organic matter, but in the poorer soils it was found that the rapid development of the fungi may lead to a partial utilization of ammonia. There was no correlation between the increase in bacterial numbers and the accumulation of ammonia when soils containing different amounts of organic matter were compared.

It is considered possible that protozoa may become a limiting factor to bacterial development in certain abnormal soils, such as sewage-treated soils or certain greenhouse soils, where the soil is practically saturated with moisture and a great abundance of organic matter is present. It is thought, however, that in the case of normal soils the parts played by fungi and Actinomycetes in the decomposition of organic matter, the influence of the abundant development of these organisms upon bacterial numbers, and the influence of the kind and amount of organic matter upon the formation of ammonia and the multiplication of bacteria should be considered before attempting to explain the limitation of the bacteria.



[**Soil studies at the Massachusetts Station**], F. W. MORSE and C. P. JONES (*Massachusetts Sta. Rpt. 1922, p. 7a*).—In studies of lime absorption and acidity of soils, analyses of drainage waters gave consistent results, indicating that the use of ammonium sulphate exhausts the calcium carbonate much more rapidly than is the case where no nitrogen has been applied, while sodium nitrate removes less calcium carbonate than either. This is true at all seasons of the year when water has flowed from the drains.

In studies of the effect of potassium sulphate and potassium chlorid on soils, analyses of twigs and canes from currants, gooseberries, and blackberries grown on soils fertilized with one or the other of the two potash salts gave some evidence that there is a difference in composition produced by the different fertilizers. The proportion of sugar was consistently lower in the wood of the plants grown on soils treated with potassium chlorid, starch and pentosans were not so consistent, and an actual absorption of chlorids was demonstrated.

**Experiments with fertilizers** (*South Carolina Sta. Rpt. 1923, pp. 38-45, fig. 1*).—The results of field tests at the station farms and of cooperative tests with farmers to determine the best fertilizers for producing cotton most economically under boll weevil conditions are briefly summarized. These indicate in general that the cotton soils of the State are most deficient in nitrogen and that phosphorus is the next factor limiting plant growth. Potash has not been of as much benefit as either nitrogen or phosphorus on the majority of the soil types.

**Artificial fertilization in forestry**, SCHWAPPACH (*Ztschr. Pflanzenernähr. u. Düngung, 1 (1922), No. 11, Wirtschaft.-Prakt., pp. 520-525*).—The results of experimental work and actual practice in the artificial fertilization of forest soils in different parts of Europe are briefly summarized, and accepted practice in this respect is outlined. It is brought out that European forest soils are most usually deficient in nitrogen and moisture.

**Use of liquid manure in France and Germany**, A. MAUPAS (*L'Emploi du Purin en France et en Allemagne. Paris: Libr. Agr. Maison Rustique, [1923], pp. XII+86, figs. 7*).—This publication deals with modern methods for the production, conservation, and use of liquid manure in France and Germany. Chapters 1 and 2 are devoted to the production and conservation of liquid manure rich in nitrogen. Chapter 3 deals with modern approved methods of using this fertilizer, while chapter 4 summarizes the situation and describes equipment and apparatus for proper storage and utilization.

**Field experiments with atmospheric nitrogen fertilizers**, F. E. ALLISON, J. M. BRAHAM, and J. E. McMURTREY, JR. (*U. S. Dept. Agr. Bul. 1180 (1924), pp. 44, pls. 14, figs. 4*).—The results of three years' field experiments at Muscle Shoals, Ala., begun in 1919 by the U. S. War Department in cooperation with the Bureau of Plant Industry, are reported, the purpose of which was to determine the fertilizing values of cyanamid, ammonium nitrate, ammonium phosphate, ammoniated superphosphate, ammonium chlorid, a double salt consisting of ammonium nitrate and ammonium sulphate, a mixed salt obtained from ammonium nitrate and potassium chlorid, a mixed salt obtained from ammonium nitrate and potassium sulphate, urea, and Urephos. Sodium nitrate and ammonium sulphate were used as reference substances. In connection with the experiments on cyanamid, a few tests were made with calcium nitrate alone and in admixture with cyanamid and also tests on calcined phosphate and basic slag as sources of phosphorus.

Cyanamid usually was not so satisfactory as the other sources of nitrogen, chiefly because so many factors influence the rate and manner in which the material is decomposed either in fertilizer mixtures or in the soil. When mixed with acid phosphate in large proportions the results were poor, prob-



ably owing to the transformation of a portion of the cyanamid nitrogen to dicyandiamid. Where applied separately with acid phosphate, the results were good even with 1,000 lbs. of an 8-8-4 fertilizer. Calcined phosphate and basic slag appeared to be entirely satisfactory as to compatibility as sources of phosphorus for use with cyanamid.

The behavior of cyanamid in the soil was found to depend upon a number of factors, such as time and method of application and the type, composition, temperature, and moisture content of the soil. Applications should be made at the time of seeding, or preferably earlier. It is believed that thorough mixing of the cyanamid with the soil is preferable to drilling in the row. Even under the best conditions cyanamid nitrogen is converted to nitrates rather slowly, and for this reason is usually slow to act. The soil conditions which are known to hasten nitrification are, in general, the ones which favor an efficient utilization of cyanamid.

The marked differences in the response of different crops to cyanamid under the same conditions were very clearly brought out by the experiments with corn and cotton. Corn gave as good yields in most instances with cyanamid as with any other fertilizer used, and only a very temporary period of retardation was in evidence during early growth. Cotton was usually retarded for a considerable period subsequent to germination, and in most cases never produced as good growth or as large yields with cyanamid as with ammonium sulphate or sodium nitrate. Where used on winter grains with half of the nitrogen supplied in the fall and the remainder in the spring, cyanamid gave about as good increases on the average as the two standard materials. Where all the nitrogen was applied in the fall to wheat and rye, the results were even better. This emphasizes the desirability of allowing a considerable period of time for cyanamid to become available in order that it may produce the maximum yields.

The comparisons between acid phosphate, calcined phosphate, and basic slag made in connection with the use of cyanamid showed only slight differences in yields, but the experiments were on too limited an area and for a period too short to justify a definite statement as to their relative values. The attempts to utilize cyanamid more effectively by the addition of calcium nitrate to mixtures containing it were not entirely successful. This was attributed to the fact that where calcium nitrate is used with basic slag the mixture becomes moist during damp weather and on drying produces very hard cakes. At the same time the moisture probably favors the production of dicyandiamid from the cyanamid present.

Ammonium nitrate gave results comparable with sodium nitrate and ammonium sulphate. It was readily available, and no abnormal effects were noted. The chief limitation to its use is its property of absorbing moisture from the air, making it somewhat unsuitable for fertilizer mixtures. This objectionable feature can be partially overcome by either graining and oil coating the material or by manufacturing double or mixed salts from it. Double salt, made from ammonium nitrate and ammonium sulphate, produced effects comparable with either of the materials used singly. The material is somewhat hygroscopic, but not nearly to the same extent as ammonium nitrate. The two mixed salts, made from ammonium nitrate and either potassium chlorid or potassium sulphate, were of approximately equal value. So far as could be judged from the limited use of these materials, they are as available as either ammonium nitrate or ammonium sulphate. Although somewhat hygroscopic, they are less objectionable in this respect than ammonium nitrate.

Ammonium phosphate and ammoniated superphosphate were found to be excellent nitrogen carriers. They gave quick responses, good growth, and



satisfactory yields. The large quantities of phosphorus in the materials partially masked the nitrogen effects. Ammonium chlorid was as readily available as ammonium sulphate, but on a few plats 40 and 80 lbs. of ammonia per acre showed some toxic effects and gave slightly lower yields than the equivalent amount of nitrogen as ammonium sulphate. Urea seemed to be as readily available as sodium nitrate and equally as good in all respects as any other material used. Since urea is an excellent material physically and leaves neither a basic nor an acid residue in the soil, it should prove to be an almost ideal nitrogen carrier for all types of soils. Urephos gave somewhat variable results, due to the wide soil variations, the yields being especially good with wheat but much poorer with rye. The limited use of the material did not justify conclusions as to its value.

It is noted that nearly all the fertilizer materials tested had a much higher plant nutrient content than those now commonly employed. While some of these materials are suitable for direct use in mixed fertilizers, others will require some modifications of present-day fertilizer practice owing to their physical condition. The results as a whole are summed up by the statement that under the conditions of these experiments all of the nitrogen materials tested, with the exception of cyanamid, were of about the same value as sodium nitrate and ammonium sulphate. With regard to the latter two materials, if there was any difference between them it was slightly in favor of ammonium sulphate. Further experimentation is considered necessary, however, to establish more definitely the relative values of all of these materials and to determine the conditions under which they can be most advantageously used.

**Experiments with Rehmsdorf organic nitrogenous fertilizer,** E. HASELHOFF (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 11, *Wirtschaft.-Prakt.*, pp. 510-519).—Pot and field experiments conducted for five years with grain and root crops on different soils, to determine the value of Rehmsdorf organic fertilizer as a source of nitrogen as compared with ammonium sulphate and plain and treated leather meal, are reported. The Rehmsdorf fertilizer consists of slaughterhouse refuse steamed and treated with acid to render the nutrient contents more available to plants.

The field experiments confirmed the pot experiments in showing very poor results for the Rehmsdorf fertilizer when applied late as compared with ammonium sulphate. It is concluded that the limited action of this organic fertilizer is strongly influenced by late application. In the pot experiments the Rehmsdorf fertilizer showed a marked action only in the fifth year, and then only when it was applied early in the previous fall. This fertilizer showed a marked residual action on wheat.

These results, compared with those obtained by studies of this fertilizer by the neutral permanganate method for determining the availability of the nitrogen content, are taken to indicate that this method does not give an accurate indication of the active nitrogen in such fertilizers. Furthermore, water solubility appeared to be no accurate measure for nitrogen activity.

**Investigations on the influence of time of application on the action of different organic nitrogenous fertilizers,** O. LEMMERMANN and H. WIESSMANN (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 12, *Wirtschaft.-Prakt.*, pp. 560-574).—The results of several years of studies with one light and two heavy soils to determine the influence of time of application upon the value of horn and blood meals and lupine meal as sources of nitrogen are reported.

The results are taken to indicate that organic nitrogenous fertilizers should be applied to light soils in early spring instead of in the fall. The importance of this increases the more easily the fertilizers are nitrified, owing to nitrogen

losses by leaching. Such fertilizers may be used on heavy soils in the fall without great danger of nitrogen losses by leaching.

**The influence of the nitrogen treatment on the content of nitrogen, carbon, and phosphoric acid in a soil varying in mechanical composition, A. W. BLAIR and A. L. PRINCE** (*Soil Sci.*, 16 (1923), No. 2, pp. 115-119).—Studies conducted at the New Jersey Experiment Stations are reported in which equivalent amounts of nitrogen in the form of sodium nitrate and dried blood were compared for a period of 10 years in cylinder experiments on a soil varying in mechanical composition from loam to coarse sand. With the exception of the first year, two crops were grown each year, the fertilizer in every case being applied to the first crop.

There was a wide difference in the yields of dry matter on the check cylinders as compared with those on the nitrogen-treated cylinders, and a slight difference in the percentage of nitrogen and carbon in the soils from the cylinders receiving the different treatments.

The results are considered to emphasize very strongly the importance of available nitrogen as distinct from total nitrogen, and likewise the failure of the determination of the chemical ingredients of a soil in forecasting the productiveness of that soil. The phosphoric acid content was essentially the same in the soils without nitrogen treatment as in those which received the sodium nitrate and dried blood treatments. Indirect evidence was obtained that the check cylinders lost more phosphoric acid through leaching than did the nitrogen treated cylinders.

**Several years cropping practice without phosphoric acid additions and its yields, O. NOLTE** (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 4, *Wirtschaft.-Prakt.*, pp. 210-217).—Data from long-time cropping experiments without phosphoric acid fertilization, conducted at several German experiment stations, are briefly summarized. While the balance of the original soil supply of phosphoric acid and of the income and outgo of that material during several years of cropping indicate a gradual decrease in the supply of phosphoric acid in the soil, the cropping results indicate that under certain conditions continuous extraction of phosphoric acid from the soil by cropping for a period of ten years will not necessarily entail a decrease in crop yield.

**Comparative effects of muriate and sulphate of potash on the soil in a long continued fertilizer experiment, F. W. MORSE** (*Soil Sci.*, 16 (1923), No. 2, pp. 107-114).—Studies conducted at the Massachusetts Experiment Station are reported in which the chemical behavior of soil from three plats treated for 22 years with potassium chlorid was compared with that of soil from three adjacent plats treated during the same time with potassium sulphate. Analyses of these soils showed slightly more lime in the potassium chlorid series when determined by fusion and by N/5 nitric acid. All other results were practically alike in both soils.

Percolation experiments with columns of soil taken directly from the plats yielded slightly more total solids from the potassium chlorid series, while the sulphate series yielded more lime. A N/10 solution of potassium sulphate dissolved more calcium from the air-dry sulphate soils than a similar solution of potassium chlorid removed from the chlorid soils. The potassium chlorid solution removed more sodium than calcium. The reactions of water solutions of these soils were very slightly acid, being least in those from the potassium chlorid soils.

It is concluded that the long continued use of the two potash salts produced no important cumulative differences in the chemical properties of this soil, and that potassium chlorid is no more and possibly is less exhaustive of lime in the soil than potassium sulphate.



**A preliminary study of the effects of sodium chlorid upon alfalfa grown in solution cultures,** S. LOMANITZ (*Soil Sci.*, 16 (1923), No. 3, pp. 183-193, figs. 4).—Studies conducted at the New Jersey Experiment Stations, in which alfalfa was grown for 98 days in various culture solutions containing different amounts of sodium chlorid, showed that solutions containing sodium chlorid gave higher yields than did the Tottingham culture solution. The greatest increase was obtained with the solution in which 0.1 atmosphere osmotic concentration of sodium chlorid was substituted for the 0.1 atmosphere of potassium nitrate in the Tottingham solution. The roots showed a greater relative increase than did the tops, and there was no appreciable difference in the nitrogen content of the whole plant between the plants of the different cultures. The chlorin content increased uniformly with the increasing supply of that element. The pH values of the discarded solutions gradually approached neutrality with the advancing growth of the plant.

**The transient nature of magnesium-induced toxicity and its bearing upon lime-magnesia ratio studies,** W. H. MACINTIRE and J. B. YOUNG (*Soil Sci.*, 15 (1923), No. 6, pp. 427-471, figs. 5).—Cylinder studies with tall oat grass and cowpeas, conducted over a period of years at the Tennessee Experiment Station to determine the nature of the toxicity produced by magnesium and its influence upon lime-magnesia ratio studies, are reported.

The results showed that a toxicity lethal to three seedlings of tall oat grass prevailed during the initial year where heavy additions of precipitated magnesium carbonate had been made, although the carbonate additions were completely decomposed. This initial toxic condition was succeeded by a beneficial effect. No toxic effect was produced upon either tall oat grass or cowpeas by heavy additions of dolomite, which proved to be about as valuable as limestone of similar fineness and chemical equivalence.

Pot tests indicated an initial toxicity of magnesium carbonate to cowpeas, but this disappeared at the end of the first year in unleached pots. A preponderance of magnesium salts over those of calcium was found in the several zones when the soils were leached at the time of harvesting of the cowpeas. Determinations of pH value made in 1922 of distilled and carbonated water extracts from samples of soils taken in 1913 and 1918 showed that the aged magnesian noncarbonate residues indicated acidity, while the reverse was true in the case of calcium carbonate residues.

Leaching data on the annual and total outgo of magnesium and the progressive decrease in solubility of magnesian additions during a 5-year period established the fact of an occurrence of a large residue of noncarbonate magnesium in the cylinders during the period of lethal toxicity and subsequent fertility, and determined the forms in which the magnesium was leached in the soil during the prevalence of these two conditions.

The data further showed that the slow hydration and carbonation of magnesium oxid in the atmosphere is altogether different from the problem of magnesium oxid conversion to carbonate in the body of the soil. With widely alternating ranges of solubilities of calcium and magnesium there appeared to be no correlation in the effects produced upon plant growth.

The results of the experiments given in this contribution are considered with reference to their bearing upon some of the previous investigations on the validity of the so-called lime-magnesia hypothesis of Loew.

**Action of increased carbon-dioxid additions to sand and cultivated soils,** A. DENSCH and T. HUNNIUS (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 5, *Wirtschaft.-Prakt.*, pp. 241-252, fig. 1).—Experiments with sand and other soils and different crops to determine the influence on crop yield of increasing

the carbon-dioxid content of the soil atmosphere with artificial watering are reported.

The results on sand soil showed that increasing the carbon-dioxid content of the soil air had an injurious influence on the growth and yield of crops. This injurious effect of carbon dioxid was not so evident on other cultivated soils, especially those well supplied with humus.

Experiments with guanol on sand soils led to the conclusion that the use of this and similar materials solely as a source of carbon dioxid is generally inadvisable.

**Report on commercial fertilizers, 1923**, E. M. BAILEY (*Connecticut State Sta. Bul.* 250 (1923), pp. 3-88).—This contains the provisions of the Connecticut fertilizer inspection law, a list of fertilizer registrations in the State during 1923, and guaranties and actual analyses of 859 samples of fertilizers and fertilizer materials and miscellaneous materials collected for inspection in the State during 1923.

**Commercial fertilizers, 1923**, J. M. BARTLETT (*Maine Sta. Off. Insp.* 109 (1923), pp. 29-52).—The results of actual analyses and guaranties of 275 samples of fertilizers and fertilizer materials collected for inspection in Maine during 1923 are presented. The nitrogen and phosphoric acid results are considered to be very good, with a few exceptions, but it is noted that quite a large number of potash results, particularly the higher percentages, fall slightly below the guaranties. The chief points of the fertilizer law are briefly enumerated.

**Inspection of fertilizers**, P. S. BURGESS and J. B. SMITH (*Rhode Island Sta. Ann. Fert. Circ.*, 1923, pp. 13).—Guaranties and actual analyses of 95 samples of fertilizers and fertilizer materials, limes, and wood ashes collected for inspection in Rhode Island during 1923 are presented and briefly discussed.

**The Missouri fertilizer law**, F. B. MUMFORD and L. D. HAIGH (*Missouri Sta. Circ.* 114 (1923), pp. 4).—The text of the law is given.

## AGRICULTURAL BOTANY.

**Elements of plant biology**, A. G. TANSLEY (*London: George Allen & Unwin, Ltd.; New York: Dodd, Mead & Co.*, 1922, pp. 410, figs. 63).—This book is intended primarily for medical students, and for others who do not intend to continue the study of botany further than an elementary knowledge of plants, particularly in relation to general biology. The book is based on the first portion of the course in elementary biology for the preliminary examination in science and the first examination for the M. D. degree at Cambridge. This first portion of the course, which is covered by the present work, occupies one term and comprises 24 lectures and 48 hours of practical work in the laboratory. A rudimentary knowledge of inorganic chemistry is assumed.

**Practical plant biochemistry**, M. W. ONSLOW (*Cambridge, Eng.: Univ. Press*, 1923, 2. ed., pp. [5]+194).—To make space for material considered of greater present value a few of the experiments given in the first edition of this work (*E. S. R.*, 47, p. 522) have been omitted. Plant metabolism is further dealt with. Certain corrections are included. The chapter on the colloidal state is intended to give a preliminary conception only of the importance of such phenomena.

**Botanical microtechnique**, H. SCHNEIDER (*Die Botanische Mikrotechnik. Jena: Gustav Fischer*, 1922, 2. ed., pp. XII+458, figs. 220).—This work, a manual of modern microscopy as applying to general method, special technique, and plant materials, is said to have been undertaken at the request of the author (A. Zimmermann) of the book (of the same title published in 1892) to which



it is regarded as a second edition, though really an entirely new book in all respects for which the present author assumes full responsibility.

**A popular dictionary of botanical names and terms**, G. F. ZIMMER (London: George Routledge & Sons, Ltd.; New York: E. P. Dutton & Co. [1923], 2. ed., pp. VI+122).—This little dictionary is intended for the use of lovers and students of plant life in garden, field, and wood. It is the primary object of the book to make the names of plants more interesting by giving their equivalents in English. In many cases an explanation, or a free rather than a literal translation, is given.

**The effect of the reaction of a nutritive solution on germination and the first stages of plant growth**, R. M. HIXON (*Meddel. K. Vetensk. Akad. Nobel-inst.*, 4 (1920), No. 9, pp. 28, figs. 12).—Data from observations cited having emphasized the importance of the soil reaction in the struggle for existence of plants, the present studies were undertaken regarding the chemical equilibrium of physiology, and the results are presented in the form of physiological experiments as an orientation for later chemical examination. Both methods and data are detailed for *Pisum* sp., *Zea mays*, *Avena sativa*, *Triticum vulgare*, and *Daucus carota*. The two contradictory facts that a relatively broad zone exists for the pH, and yet that a variation is noted in the plant structure, are held to indicate that a standard is needed for discriminating between normal and abnormal growth.

Seeds of the culture plants have the ability to germinate over the wide range of pH 4 to 7.6 with only slight variation at the two extremes. In the central part of this range a point was found at which the rate of germination is decreased. This point for two varieties of peas fell at pH —5; for corn, wheat, and oats at pH —6; and for carrots at pH —5.5.

The root growth of carrots was a maximum at this critical point at the end of the tenth day; for the other plants the critical point gave a minimum growth lasting for from 15 to 20 days.

A measurable difference appears in the percentages of ash, water, and organic matter in the roots of 16-day wheat seedlings germinated and grown at various reactions. Statements from authors cited give strong indications of an ionic equilibrium between the roots of the plant and the nutritive salts.

Root excretions of a gelatinous nature (not protein) were observed, and in the case of *D. carota* the quantity of this precipitate was minimum at the critical point pH —5.5. The quantity of this excretion decreased with time, indicating some process of protection.

A colored and reactive compound was noticed in the beakers containing germinating carrot seeds, in quantities sufficient to indicate the possibilities of chemical identification. This is to be further studied.

Growth to maturity and comparison of composition with that of plants growing under natural conditions is stressed as the only criterion for normal growth.

**Aeration and air content**, F. E. CLEMENTS (*Carnegie Inst. Wash. Pub.* 315 (1921), pp. 183).—The author has given a digest of the literature dealing with the respiration of roots and with anaerobiosis so far as these have to do with transpiration, growth, or movement, or serve to throw light upon the questions of bog toxins, acid soils, or toxic exudates. In addition, an account is given of the development of views upon bog xerophytes and soil toxins.

**The influence of the temperature of the soil on the relation of roots to oxygen**, W. A. CANNON (*Science*, 58 (1923), No. 1504, pp. 331, 332).—From experiments with *Potentilla anserina* and a garden variety of corn and other plants, the author found that under conditions of a diminished oxygen supply

the maximum, optimum, and minimum temperatures for root growth were greatly modified. The physiological and ecological significance of the limitation of oxygen in soils on plant growth is discussed.

**The absorption of carbon by the roots of plants**, J. F. BREAZEALE (*Jour. Agr. Research* [U. S.], 26 (1923), No. 7, pp. 303-311).—The results are given of experiments with wheat seedlings grown in culture solutions.

It was found that the presence of sodium or ammonium nitrate, or of calcium, sodium, or potassium carbonate, in cultures for wheat seedlings is followed by the presence of carbonates in the ash of the plants. When sodium nitrate was present in the culture solution the plants were said to first absorb the  $\text{NO}_3$  ion, leaving in the solution some sodium which combines with the water and with the carbon dioxide dissolved in the solution to form sodium carbonate or bicarbonate. This in turn gives up its  $\text{CO}_2$  to the plant which absorbs it by means of its roots. The plant is believed to absorb  $\text{CO}_2$  as an ion or exudes carbon dioxide for the purpose of maintaining equilibrium in its tissues or in the nutrient solution. Wheat plants did not appear to be able to absorb carbon dioxide from its solution in water without the presence of a soluble base. The absorption of a basic radical, as potassium, is believed to depend largely upon the absorption of an acid radical.

The author considers that the term "lime-loving," as applied to plants, might be more properly called "carbonate-loving."

**Further observations on the osmotic pressure of the juices of the potato plant**, B. F. LUTMAN (*Jour. Agr. Research* [U. S.], 26 (1923), No. 6, pp. 243-256).—In 1918 experiments were conducted to ascertain whether the internal osmotic pressures of the juices from different parts of the potato plant varied in such a way as to be a factor in the production of tipburn (*E. S. R.*, 43, p. 131). These and similar experiments were repeated in subsequent years, and the general results of 1918 were confirmed. The growing portions, usually the young leaves and branches, have a higher osmotic pressure in their cell sap than there is in the sap of the old leaves, stems, or new tubers. The stems were found usually to show the highest pressure during the height of activity of the plant, apparently because of the presence of a high percentage of reducing sugars. Potato plants taken from fields at the height of plant activity showed superior pressure in the young leaves and shoots, and the plants were apparently still growing at that time without any symptoms of tipburn. Plants grown under cloth shade had less osmotic pressure in the juices of the foliage parts as compared with plants grown in the open. Mosaic plants were found to have a higher osmotic pressure in the leaves than healthy ones, but this did not appear to be true of the stems. The osmotic pressure is said to be greater in some years than in others, depending upon the weather; a wet year lowering the pressure, while a dry year raises it.

Comparisons were made between the potato plant and others, and the pressure varied more between different parts of the potato plant than it did between those of the artichoke or dahlia. Potato plants grown in the greenhouse never developed a superior osmotic pressure in the stems, while the pressure in the leaves was always much higher. The osmotic pressure in the new tubers was about the same as that of field-grown plants, probably because of the rather dry condition of the soil.

**Physiological stability in maize**, W. E. TOTTINGHAM (*Science*, 59 (1924), No. 1516, pp. 69, 70).—Contrary to work reported with other cereals (*E. S. R.*, 44, p. 723; 48, p. 633), the author found from field and greenhouse experiments that dent corn has great physiological stability. In his experiments the application of nitrate of soda to growing maize plants did not modify the nitrogenous content of the cured seed except in one trial conducted with insufficient



illumination during winter months. Differences in latitudes at which corn was grown did not change the protein content of the seed in three out of four seasons.

Attention is also called to the fact that while the leaves of maize and mangolds have the same synthetic function, their chemical composition and physiological behavior are quite different.

**Further observations on cell-wall structure as seen in cotton hairs,** W. L. BALLS and H. A. HANCOCK (*Roy. Soc. [London], Proc., Ser. B, 93 (1922), No. B 654, pp. 426-440, pl. 1, figs. 5*).—The present note summarizes the results of observations made subsequent to the recognition of growth rings in the cell wall (E. S. R., 43, p. 633). These observations are related to previous physiological studies, and most of them were made on dated bolls (E. S. R., 35, p. 230) and pure-line plat crops.

The authors conclude that a spiral fibrillar radial structure exists in every growth ring of the cell wall of the cotton fiber, the simple pits of the cell wall being a special case of this general structure. The pattern of the spiral, which appears to be predetermined during growth in length, is preserved through all the growth rings of the secondary wall thickening. The number of fibrils in the cross section of one fiber is of the order of 1,000 upwards. The pattern (direction, reversal, and pitch) of these spirals seems to be the major determinant of the externally visible convolutions of the fiber. There are indications that the unknown cellulose aggregates which compose any one spiral fibril have a definite geometric conformation, suggestive of stereo-isomerism. Attempts to elucidate the cellulose structure further, as by X-rays, will probably have to take account of this spiral fibril arrangement.

**The determiners of cellulose structure as seen in the cell wall of cotton hairs,** W. L. BALLS (*Roy. Soc. [London], Proc., Ser. B, 95 (1923), No. B 665, pp. 72-89, pls. 2, figs. 5*).—Observations were chiefly made on fibers at all stages of development, grown on Sakel (Egyptian) plants in a greenhouse but checked on other material. The direction of convolutions formed in isolated fibers is determined entirely by the spiral reversals of wall construction. Certain chemical relationships are indicated by the facts that the wall does not fall into convolutions following mere plasmolysis but does so on drying, that this loss of constructional water is irreversible, and that the structural relationships to polarized light are but little affected by strong alkalis but are readily abolished by acids.

Two cases of mirror image structure appear to exist in the fiber wall, although these do not necessarily imply stereo-isomerism. In both cases the surface of reversal is at a normal to the current direction of growth. The secondary wall visible structure is shown to form mirror images on either side of a reversal point. The primary wall structure is conjectured to consist of two concentric cylindrical layers (probably molecular), whose structures are mirror images. At reversal points these layers are presumed to change places.

The structures formerly termed slow spirals are designated as slip spirals. The slip spirals seem to be invariably opposed to the pit spirals, thus resembling cleavage planes. The single slip spiral of the cotton secondary wall is considered equivalent to the twinned slip spirals of wood cells, and it exists as a twin in the primary wall.

The number of structure reversals in the wall of one fiber cell fluctuates around a mode of about 30, indicating that a tendency to the formation of one complete (double) reversal daily during growth in length is still a possible view. The full number is present as soon as secondary thickening begins. No means for demonstrating the presumed reversals in the primary wall have yet been devised.

Two helical spirals were found, one seen in both primary and secondary wall (slip spiral) at  $70^\circ$  being twinned right- and left-handed in the former only, while the other in the secondary wall, called the pit spiral, appears to have a constructional angle of  $29^\circ$ , subsequently reduced by torsion during growth in thickness. The tangents of these angles happen to stand almost exactly in the ratio of 4:1, which suggests polymerization, as does also the change in number of extinction positions. Some tentative speculations as to its ultimate structure are made, in terms of a space-lattice hypothesis.

In the introduction, attention is called to the spongy structure of the cotton cell wall, the specific gravity of which is nearer to 1 than to the value of 1.55 accepted for cotton cellulose itself.

**Citric acid as a source of carbon for certain citrus fruit-destroying fungi**, A. F. CAMP (*Ann. Missouri Bot. Gard.*, 10 (1923), No. 3, pp. 213-298, pl. 1, figs. 21).—The work reported here was undertaken with the idea that the fungi which rot citrus fruits probably show some peculiar metabolic adaptations to life in such an acid environment as that furnished by the citrus fruits in general, and particularly by lemons. In the first part of this paper considerable space is devoted to the methods utilized in this research, as well as to some notes on the chemistry and occurrence of citric acid. In the execution of the physiological side of the work the utilization of citric acid as a source of carbon for fungi is the special phase considered.

An improved method for the determination of citric acid said to be especially applicable to culture solutions has been offered, and the application of the wet combustion method for the determination of total carbon to physiological work has been indicated. A number of fungi which attack citrus fruits have been studied with regard to their ability to utilize citric acid as a source of carbon, with the general result that none of the fungi was found to thrive on citrates as the sole source of carbon, though citrate mixtures adjusted to a favorable pH proved to be efficient supplementary carbon sources, when used with small quantities of dextrose, for all the fungi used, with the exception of *Penicillium digitatum* and *Phomopsis citri*. After a mat had been grown on dextrose, free citric acid was utilized readily by *Penicillium stoloniferum*, *Penicillium* sp., and *Aspergillus* sp.; less readily by *Sclerotinia libertiana*; and slightly or not at all by mats of *Diplodia natalensis*, *Phomopsis citri*, *Alternaria citri*, *Alternaria* sp., and *Penicillium digitatum*. The response of the fungi in this respect was coordinate with their tolerance of the H-ion concentration. Studies were carried out with other fungi named. Acidic and alcoholic products were formed under unfavorable environmental conditions, such as lack of oxygen and unfavorable pH.

It is pointed out that tolerance or utilization of free citric acid is probably not an important factor in the specialized parasitism of such fungi as *Phomopsis citri*, *Penicillium digitatum*, *A. citri*, *Alternaria* sp., *S. libertiana*, and *D. natalensis*, but that it probably is a factor in the destructive rotting of injured fruit by numerous fungi which cause this final collapse. Under suitable environmental conditions *P. stoloniferum*, *Penicillium* sp., and *Aspergillus* sp. would probably come in the latter category.

**Development and biology of the Protomycetaceae**, G. VON BÜREN (*Beitr. Kryptogamenflora Schweiz*, 5 (1922), No. 3, pp. [5]+94, pls. 2, figs. 27).—The four main parts of this contribution deal with forms of the genus *Protomyces* inhabiting, respectively, Umbelliferae and Compositae, and with species of *Protomycopsis* and of *Volkartia*.

**Longevity in spores of *Aspergillus oryzae* and *Rhizopus nigricans***, A. MCCREA (*Science*, 58 (1923), No. 1508, p. 426).—As a contribution to the longevity of spores, the author reports experiments with *A. oryzae* in which coni-



dial material collected in 1897 was in 1919 inoculated into nutrient media and the organism developed upon every medium tried. The longevity of *R. nigricans* was also unintentionally demonstrated, the spores of that fungus having found entry into the original culture.

**Winter injury of brambles**, J. K. SHAW, F. W. MORSE, and O. L. CLARK (*Massachusetts Sta. Rpt. 1922, pp. 8a, 9a*).—Other experiments having shown some differences in the composition of twigs and canes of currants, gooseberries, and blackberries due to different fertilizers, samples of wood growth were taken for analysis from the two potash plats. Pentosan determinations failed to indicate a higher content on the hardier plants grown on the sulphate plat.

## GENETICS.

**Polymorphism in pure lines of Petunia**, M. SACHS-SKALIŃSKA (*Pam. Zakł. Genetycz. Szkoły Głównej Gosp. Wiejsk. (Mém. Inst. Génétique, École Supér. Agr. Varsovie)*, No. 1 (1921), pp. 15–33, pl. 1, figs. 2).—Technical descriptions are presented for two polymorphic strains of *Petunia* found in 1914 in an apparently stable variety of *P. violacea* whose flowers were uniformly specked with reddish violet and were of constant shape. On the other hand, the individuals of the polymorphic strains showed a wide range in color and shape, all the way from normal to an entirely new form having a narrowed corolla of variable shape, with violet throat surmounted with a ring and spots of reddish violet. The author states that the cause of these mutations is nonhereditary and unknown.

**A mutant of the Old English rat**, F. A. E. CREW (*Jour. Heredity*, 14 (1923), No. 5, pp. 220–222, fig. 1).—The occurrence and behavior in heredity of a mutant of the Old English Black rat (*Mus rattus rattus*), having black eyes, a creamy white body, and slaty colored ears and tail, are described. These specimens were found wild and have been crossed with both wild black and wild white bellied agoutis behaving as a recessive character in each case. Matings between the mutants, both by H. C. Brooke, the discoverer, and by the author at the animal breeding research department of the University of Edinburgh, have shown that they breed true. In the crosses some of the specimens produced varied in body color to pale fawn. The mutants would not mate with the fancy white rat, *M. norvegicus*.

**On the offspring of rabbit does mated with two sires simultaneously**, S. KOPEĆ (*Jour. Genetics*, 13 (1923), No. 3, pp. 371–382, fig. 1).—This is an English report of the experiments previously noted (E. S. R., 49, p. 266), with additions to the numbers of offspring produced where only one sire was effective.

**The inheritance of degrees of spotting in Holstein cattle**, L. C. DUNN, H. F. WEBB, and M. SCHNEIDER (*Jour. Heredity*, 14 (1923), No. 5, pp. 229–240, figs. 7).—The results of a study of the inheritance of the amount of spotting in Holstein cattle, made at the Connecticut Storrs Experiment Station from the records of the Holstein-Friesian Association, are reported. The amount of black on an animal was determined by the number of squares of coordinate paper required to cover it when the coordinate paper was placed on the outline of the record of the colors of the animals kept by the Holstein-Friesian Association. The total outline of each animal occupied about 950 squares.

In making the study, approximately 50 offspring of each of 3 bulls designated as light (50 squares of black), medium (350 squares of black), and dark (900 squares of black) were studied as to the number of units of black making up the color pattern of each offspring and the dam of each. A comparison of the amount of black on the two sides of the 294 animals studied

showed that a correlation of  $0.971 \pm 0.002$  existed. Some evidence from a comparative study of the coats of males and females indicated that the males were slightly darker than the females. In respect to the relation of the units of black in the pattern of the sire and dams to the offspring, the averages of the parents and offspring, respectively, of the 3 bulls were 220 and 201, 449 and 430, and 623 and 638. The average grades of the dams mated with each bull were approximately equal. The relation of the amount of black on the dams and offspring was studied by correlation. In the case of the matings with the light bull the coefficient was  $0.61 \pm 0.06$ , with the medium bull  $0.05 \pm 0.1$ , and with the dark bull  $0.34 \pm 0.08$ .

The authors state that these results indicate a partial dominance of the dark spotting, and as further evidence matings and offspring were grouped and the results presented below. The grades used in the table were light 0-249 units of black, medium 250-699, and dark 700-949 units of black.

*Results of crosses among Holstein cattle of various grades of spotting.*

Parents.	Offspring.			
	Light (0-249).	Medium (250-699).	Dark (700-949).	Mean grade offspring.
Light ♂ × light ♀	13	2		125.00+81.86
Light ♂ × dark ♀	1	7		431.25+31.24
Light ♀ × dark ♂	3	12	6	555.95+33.85
Medium ♀ × medium ♂	6	13	2	457.86+32.38
Medium ♀ × light ♂	20	7		175.00+15.77
Medium ♂ × light ♀	3	5	2	370.00+50.98
Medium ♀ × dark ♂	3	7	14	677.09+34.21
Medium ♂ × dark ♀	2	10	6	566.67+37.12
Dark ♂ × dark ♀		1	4	795.00+56.11

Quantitative determinations of nongenetic variation could not be made, but the indications were that more or less nongenetic variation was also operative in determining the coat pattern.

**Inheritance of growth habit, pod color, and flower color in soy beans,** C. M. WOODWORTH (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 12, pp. 481-495, pls. 2, figs. 3).—Two types of growth habit in soy beans, a tall luxuriant growing, late maturing type and a low, compact, early maturing type, are described from studies at the Wisconsin Experiment Station. Genetically the two types behave as allelomorphic characters, the first being dominant. The genetic difference between them appears to be determined by a single factor pair. *S s*.

Dark colored and light colored pods constitute an allelomorphic pair of characters, dark being dominant to light and differing from it by a single factor pair, *L l*. Purple (colored) and white flower color constitute a simple Mendelian pair of characters, purple being dominant to white. The factor pair, *W w*, is proposed. Perfect correlation apparently exists between flower color and stem color, purple flowers always accompanying purple stems, and white flowers, green stems.

**The inheritance of the number of boll loculi in cotton,** S. C. HARLAND (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem.*, 2 (1923), No. 26, pp. 346-352).—Crosses between three strains of Sea Island cotton and between three types of West Indian perennial cotton and a pure type of Upland, involving various types of locus number, are described. The author concludes that meristic characters are inherited, and that there is strong evidence that the results can be interpreted on a factorial basis.



**Correlation of characters in Texas cotton**, H. DUNLAVY (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 11, pp. 444-448).—Observations on 167 cotton plants revealed the following correlations: Lint index and weight of seed  $0.704 \pm .0208$ , boll size and weight of seed  $0.664 \pm .0338$ , percentage of 5-lock bolls and boll size  $0.533 \pm .0577$ , weight of seed and lint percentage  $-0.529 \pm .0376$ , boll size and lint index  $0.48 \pm .0461$ , lint percentage and staple  $-0.445 \pm .0419$ , weight of seed and staple  $0.426 \pm .0428$ , and boll size and lint percentage  $-0.394 \pm .0506$ . Of the possible 6 characters, boll size correlates with 4, weight of seed 4, lint percentage 3, staple 2, lint index 2, percentage of 5-lock bolls 1, and seeds per lock with none.

**Correlation between certain characters of the Green Mountain Irish potato**, T. K. WOLFE (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 11, pp. 467-470).—No relation seemed to exist between the yield of marketable tubers and the tuber characters of Green Mountain potatoes studied at the Virginia Experiment Station. However, the yield of marketable tubers had a high, positive correlation with the number of tubers produced and a significant negative correlation with the yield of nonmarketable tubers.

The correlation of the number of eyes with length, volume, and weight of the tuber was high and positive. However, the correlation with circumference, width, and thickness of the tuber, the number of tubers produced, yield of marketable tubers, and yield of nonmarketable tubers was insignificant.

The weight of tubers was apparently closely correlated in a positive manner with length, circumference, width, and thickness of tubers. The correlation with the number of tubers produced was slightly significant, but not significant as regards the yield of nonmarketable tubers.

**Linkage relations in the cotton plant**, K. I. THADANI (*Agr. Jour. India*, 18 (1923), No. 6, pp. 572-579, fig. 1).—Cases of single, double, and triple linkage in cotton are described. Crosses between No Lint, a naked seed cotton, and Lone Star, Acala, and Texas Rust gave indications that the factors naked seed and low lint percentage and their allelomorphs fuzzy seed and high lint are completely linked without any crossover, which accounts for the absence of double-recessive fuzzy low type. In No Lint  $\times$  Texas Rust (naked low white  $\times$  fuzzy high yellow) the factor for lint color considered in relation to the other two factors seems to display simple Mendelian inheritance, but the factors for seed fuzziness and amount of lint show complete linkage. In crosses of Red Leaf with Durango, Acala, and Rowden cotton the red coloration of the plant was found to be linked with cluster habit of fruiting as seen in Red Leaf, and (vice versa) green color of the plant is linked with noncluster habit of fruiting. In No Lint  $\times$  Red Leaf four factors are involved, and three systems of linkage are found. It is thought that linkage such as described may be of great importance in breeding types of cotton of commercial value.

**Concerning hybrids between cabbage and kale**, E. MALINOWSKI (*Pam. Zakł. Genetycz. Szyoty Główne i Gosp. Wiejsk. (Mém. Inst. Génétique École Supér. Agr. Varsovie)*, No. 1, (1921), pp. 1-14, pls. 6. figs. 2).—Linkage was observed in the  $F_2$  generation of hybrids between heading types of cabbage and curly-leaved forms such as kale. The heading character was found to be invariably linked with noncurling leaf characters. Reciprocally, nonheading was always associated with curly leaves. The  $F_1$  generation was intermediate in respect to these characters, while the  $F_2$  contained plants that resembled either parent and all gradations between them. As a result of the studies, a suggested genetic constitution is proposed for cabbage and kales in respect to heading and leaf characters.

**The internode length and number of spikelets in some wheat hybrids**, B. KAJANUS (*Hereditas*, 4 (1923), No. 3, pp. 290-340).—Studies on internode

length of spikes and number of spikelets in crosses between *Triticum vulgare* and *T. spelta*, *T. turgidum*, and *T. dicoccum*, and reciprocal crosses between *T. compactum* and *T. spelta* are detailed. Three generations were analyzed.

In *T. vulgare* × *T. spelta* the spelta plants had a greater internode length and fewer spikelets than the corresponding vulgare plants. The heterozygotes were intermediate in both respects, yet tending toward the internode length of *T. spelta* and the spikelet number of *T. vulgare*.

Reciprocal crosses of *T. compactum* × *T. spelta* gave rise to compactum, spelta, vulgare, and compacto-spelta groups of homozygotic types, as well as to different kinds of heterozygotes. The results obtained for spelta and vulgare resembled those in *T. vulgare* × *T. spelta*, the spelta gene obviously causing an increase in the internode length and a decrease in the number of spikelets. The compactum gene seemed to act contrariwise, for compactum types had a smaller internode length and more spikelets than the corresponding vulgare types. The spelta gene behaved similarly in the presence and in the absence of the compactum gene, which had equally the same effect concerning the spelta gene. The homozygotic influence of the compactum gene seemed about as large as that of the spelta gene, thus the types of compacto-spelta resembled the corresponding vulgare types as to internode length and number of spikelets. The heterozygotic effect of the spelta gene was rather small in progenies homozygotic as to the compactum gene.

In *T. vulgare* × *T. turgidum*, turgidum, durum, vulgare, and speltoides groups of homozygotic types were obtained. Some forms with very narrow outer glumes, resembling vulgare in other respects, are called lanceolatum. The internode length was rather small in turgidum and durum types, greater in vulgare, and still greater in speltoides. On the contrary, the number of spikelets was generally large in turgidum and durum types, smaller in vulgare, and particularly small in speltoides.

In *T. vulgare* × *T. dicoccum*, dicoccum, vulgare, and spelta types appeared. The spelta types were probably formed through the combination of a spelta gene from the *T. dicoccum* parent and the vulgare gene belonging to the other parent. Some forms resembling vulgare, with very flat and dense spikes, are called compressum. The internode length of dicoccum was generally small. In spelta the internode length was generally great, whereas the vulgare progenies formed a series connecting the other groups. The number of spikelets was rather large in dicoccum, yet reduced in later forms, smaller in vulgare, and still smaller in spelta.

**Natural crossing in winter wheat**, R. J. GARBER and K. S. QUESENBERY (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 12, 508-512).—Examination of 1,461 plant rows, grown in 1922 from selections made in 1921 from 19 varieties of winter wheat at the West Virginia Experiment Station, showed about 4 per cent to be of hybrid origin, indicating clearly that natural crossing had taken place. Studies of  $F_1$  plants indicate that for the year 1921, under the conditions described, there was less than 1 per cent of natural crossing.

**Inheritance of resistance to black stem rust in crosses between varieties of common wheat**, L. E. MELCHERS and J. H. PARKER (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 31, 32).—The results are given of the study of crosses made between rust-resistant and susceptible varieties of wheat when inoculated with a strain of *Puccinia graminis tritici*, to which the variety Kanred was resistant. In the  $F_2$  generation, 1,375 plants were classed as resistant and 546 as susceptible. An  $F_3$  generation of approximately 1,750 plants was grown, and the results show that in the varieties used rust resistance is determined by a single factor difference and that resistance is dominant and susceptibility is recessive.



**The inheritance of resistance to several biologic forms of *Puccinia graminis tritici* in a cross between Kanred and Marquis wheats**, O. S. AAMODT (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 32).—In a cross between these varieties of wheat, one of which is resistant and the other susceptible to several biologic forms of rust, the  $F_3$  generation was inoculated with one of the biologic forms, and the plants were either immune or completely susceptible, there being no intermediates.

**Correlated inheritance in wheat of winter-spring habit of growth and rust resistance**, O. S. AAMODT (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 32, 33).—The results are briefly given of an experiment undertaken to produce a rust-resistant spring wheat by crossing the varieties Kanred and Marquis.

**Introductory: The general morphological and physiological importance of the oestrous problem**, C. R. STOCKARD (*Amer. Jour. Anat.*, 32 (1923), No. 3, pp. 277-283).—This is a brief survey of the relation of the oestrous cycle to other morphological and physiological changes, special attention being given to ovulation.

**Oestrus in mammals from a comparative point of view**, G. N. PAPANICOLAOU (*Amer. Jour. Anat.*, 32 (1923), No. 3, pp. 285-292).—The conditions relative to the oestrous cycle in different mammals are compared, and it is shown that though similarity exists, considerable variation also occurs in the recurrence of oestrus (polyoestrus and monoestrus), the relation to coitus and ovulation, duration and conditions surrounding prooestrus, length of cycle, etc. The cause of oestrus is somewhat speculative, but practically all agree that it is located in the ovary.

The need of further studies on oestrus in a greater number of animals is also suggested.

**Racial and familial cyclic inheritance and other evidence from the mouse concerning the cause of oestrous phenomena**, E. ALLEN (*Amer. Jour. Anat.*, 32 (1923), No. 3, pp. 293-304, figs. 6).—The length of the oestrous cycle in more than 90 mice has been studied at the Washington University, St. Louis, and it has been found that the usual cycle of 4 to 6 days may vary by the occurrence of an unusually long dioestrous interval, resulting in an 8-day or more cycle or by a continuation of oestrus for 2 or more days.

The modal length of 563 cycles based on different strains of mice was 4.5 days, but the cycles varied in different colored strains, the modes being 4 days for albinos and blacks, 5 days for yellows and grays, and nearly 6 days for browns. The average oestrous cycles of four albino litter sisters, however, were 4.8, 4.8, 4.9, and 4.9, after eliminating seven long cycles which averaged 9.8 days. The variation of different strains and of different families in the same strains suggests the operation of genetic factors in controlling the length of the oestrous cycle.

The author discusses other causes of oestrus, and concludes that neither the interstitial cells nor the corpora lutea are responsible but that the maturing follicles secrete hormones which are the direct cause. With the cooperation of E. A. Doisy such a substance has been isolated from the follicles of hog and cattle ovaries which causes typical oestrous changes when injected into spayed animals.

**The mechanism of the sexual cycle with special reference to the corpus luteum**, L. LOEB (*Amer. Jour. Anat.*, 32 (1923), No. 3, pp. 305-343).—Based on the results of experiments carried on by the author and others, mostly with rats, rabbits, and guinea pigs, the relation of the corpus luteum to the sexual cycle is discussed.

The evidence indicates that there are a number of factors tending to regulate the different parts of the sexual cycle, but that the secretions of the corpus

luteum apparently dominate the second phase and to a large extent the period of pregnancy, as well as tending to inhibit prooestrus, heat, and ovulation. There is also an interrelationship between the secretions of different organs. The presence of a corpus luteum prevents ovulation, produces proliferation of the mammary gland, and is responsible for the development of the decidua and placentomata, whereas pregnancy, the removal of the uterus, and lactation tend to preserve the corpus luteum in the ovary for an extra long period. Nidation of the egg may occur without the function of the corpus luteum and without decidual tissue, but success is more certain if the production of decidua has occurred. The removal of the corpus luteum from the pregnant animal allows ovulation to occur, which may lead to circulatory disturbances followed by hemorrhage and necrosis in the more rapidly formed new tissues.

**The oestrous cycle in the opossum,** C. HARTMAN (*Amer. Jour. Anat.*, 32 (1923), No. 3, pp. 353-421, figs. 78).—The stages of the oestrous cycle in the opossum are described in detail from a study of over 1,000 females at the University of Texas. Comparisons are also made with the stages in other animals, especially marsupials.

## FIELD CROPS.

**Correlation between the appearance of seed and its germinating and yielding capacity,** A. FRISAK (*Meld. Norges Landbr. Høiskole*, No. 4 (1923), pp. 189-236, figs. 20).—Studies were made in the greenhouse and in the field of the seed value of beans of one particular crop but varying in quality as indicated by shriveling, deformity, discoloration, flintiness, and dryness.

An increase in the shriveled condition of the seed lowered the weight of the plants produced. Plant volume was found closely related to plant weight and plumpness of the seed to yielding capacity. A depression in the end of the seed, resulting from crowding in the pod, reduced the seed value to a slight extent but apparently somewhat more when the depression occurred at the germ end.

A darkened area around the hilum, dark spots distributed over the seed, and discolorations of dark brown, dark red, and greenish brown reduced the germinating and other qualities of the seed quite perceptibly. Hard and translucent seeds ranked high in weight of plants produced and in yield, and also gave a relatively high weight per thousand seeds. Light and dry seeds, and seeds brownish violet in color did not germinate in any of the tests.

The determination of the weight per thousand seeds showed that the greater the shriveled condition of the seeds the smaller was the weight of the seeds and the weight of the plants produced from them. While greater weight, together with other seed characters, increased the yield, the weight of the seed by itself did not indicate yielding capacity when the seed showed unusual coloring or other abnormal characters.

The germination tests did not disclose the possibility of production very definitely, but in all instances low germination was followed by low yields. The result showed further that as viability declined plant weight and production also declined.

A study of nodule development on the roots indicated that the number of nodules produced seems to be determined by the general vigor of the plant.

**Effect of weight of seed upon the resulting crop,** W. E. BRENCHLEY (*Ann. Appl. Biol.*, 10 (1923), No. 2, pp. 223-240, figs. 5; *abs. in Rothamsted Expt. Sta., Harpenden, Rpt. 1921-1922*, p. 29).—Experiments with barley and peas, in which the competitive factors were eliminated as far as possible, showed that a steady and considerable rise occurs in the dry weight of the plants as the



initial weight of the seed increases. This takes place with both limited and abundant food supply. The efficiency index (rate percentage of increase per day) falls gradually as the weight of the seed rises. With prolonged periods of growth this tends ultimately to counterbalance the initial advantage gained by plants from the heavier seeds, but, with such annual crops as cereals, roots, and peas, harvesting occurs before this equilibrium is reached, leaving the advantage with the heavier seeds. The relative development of shoot and root is influenced to some extent by the initial weight of the seed but may vary with the species and with the amount of available food. The results are thought to lend support to the practice of advocating the use of large heavy seed, especially with annual crops.

[**Field crops work in South Carolina**] (*South Carolina Sta. Rpt. 1923*, pp. 37, 38, 51-53, 58, 59, 61, 62, 63-65, 65-67, figs. 6).—The progress (E. S. R., 48, p. 628) is reported of variety tests with cotton, corn, wheat, soy beans, and rice; breeding work with cotton, corn, velvet beans, peanuts, potatoes, and sweet potatoes; comparison of certified and noncertified potatoes (E. S. R., 50, p. 536); field trials of miscellaneous grasses and legumes; fertilizer studies with cotton; and pasture experiments. Organic nitrogen was found superior to inorganic nitrogen as a fertilizer for potatoes, and potassium chlorid gave better returns than potassium sulphate or kainit.

**Practical guide to tropical agriculture.—II, Extensive culture: Peanuts, cacao, coffee, sugar cane**, A. FAUCHÈRE (*Guide Pratique d'Agriculture Tropicale.—II, Les Grandes Cultures: L'Arachide, Le Cacaoyer, Le Caféier, La Canne à Sucre*. Paris: Augustin Challamel, 1922, vol. 2, pp. VIII+468, figs. 69).—Part 1 of this work has been noted (E. S. R., 40, p. 622). The present volume is concerned with the history and origin, environmental and cultural needs, management, pests, harvest, and utilization of peanuts (E. S. R., 46, p. 32), cacao, coffee, and sugar cane.

[**The Woburn field experiments, 1922**], J. A. VOELCKER (*Rothamsted Expt. Sta., Harpenden, Rpt. 1921-1922*, pp. 61-69).—Field crops investigations are reported on in continuation of earlier work (E. S. R., 48, p. 227).

The highest grain yields in the continuous wheat experiments were 18.3 bu. with 1,792 lbs. of straw from the plat receiving superphosphate and sodium nitrate, and 16.7 bu. with 1,892 lbs. of straw from the plat receiving minerals and ammonium sulphate. The untreated checks averaged 8.5 bu. of grain and 784 lbs. of straw, with rape dust there was produced 13.5 bu. of grain and 1,480 lbs. of straw, and with barnyard manure only 10.8 bu. and 1,532 lbs. With mineral manures alone there was returned 7.7 bu. of grain and 1,024 lbs. of straw.

Despite an unfavorable season, barley grew better than usual, producing the highest crop since 1917. The plat receiving barnyard manure again produced the maximum yield on the continuous barley plats, 38.3 bu. of grain and 2,204 lbs. of straw, and this was followed by a plat receiving minerals and sodium nitrate in alternate years, with 33.8 bu. of grain and 2,190 lbs. of straw. The untreated plats averaged 13.7 bu. of grain and 1,079 lbs. of straw per acre. Unlike the results with wheat, rape dust gave only a poor crop. As in previous years, potash seemed to benefit the barley more than did phosphate. The striking results showing the influence of lime indicate that lime is a necessity not only where ammonium sulphate is used continually, but is also of value where sodium nitrate has been similarly used.

The results of fertilizer tests with malting barley and potatoes and rotation and green manuring experiments are also reported on.

**Abaca number**, (*Philippine Agr.*, 12 (1923), No. 3-4, pp. 101-170, pls. 15, figs. 4).—Contributions from the College of Agriculture of the University of the

Philippines in this number are as follows: A Study on the Germination of Abaca Seeds, by L. G. Ferrer and R. B. Espino; Absorption of Complete Culture Solutions by Abaca Roots with Reference to Growth of Branch Roots, by R. B. Espino and S. M. Cruz; Soil Moisture Requirements of Young Abaca Plants, by P. Hernais and R. B. Espino; A Preliminary Study of the Salt and Fertilizer Needs of the Young Abaca Plant, by R. B. Espino and B. O. Viado; Foliar Transpiring Power of Different Varieties of Abaca Grown at the College of Agriculture, by P. Gavarra and R. B. Espino; Comparative Study of Fibers Produced by Six Varieties of Abaca when Grown in Los Baños, I-II, by R. B. Espino, F. Esguerra, and J. C. Reyes; and Comparison of Forty-seven Varieties of Abaca Grown under Los Baños Conditions, by R. B. Espino and T. Novero.

**Varieties of corn for South Dakota**, A. N. HUME (*South Dakota Sta. Bul.* 204 (1923), pp. 599-611, figs. 8).—The characteristics and behavior in tests and elsewhere of the outstanding corn varieties in the State are described. Alta (a selection from Minnesota 13), Minnesota 13, Fulton Yellow Dent, Silver King (Wisconsin 7), Wimple Yellow Dent, and Reid Yellow Dent appear to be adapted in the order given to successive sections from north to south in the State. The origin of All Dakota, a yellow dent corn for the northern half of the State, is told briefly.

The tabulations appended are probably records of the annual precipitation at the station and substations.

**[Cotton investigations in South Carolina]** (*South Carolina Sta. Rpt.* 1923, pp. 29-36, 37, 61, fig. 1).—Cotton spaced from 6 to 12 in. apart in rows from 3 to 3.5 ft. apart generally gave highest yields in spacing tests during three years. Seed delinted with sulphuric acid came up quicker and the plants made heavier first pickings and total yields than seed either rolled in soda, delinted with hydrochloric acid gas, or delinted at the oil mill. The gain is thought to be probably due largely to disease control by the sulphuric acid treatment.

A complete fertilizer has given the most rapid fruiting and the earliest maturity. Maximum yields and the very earliest cotton were produced in 1923 where from 5 to 6 per cent of nitrogen and 8 per cent of phosphoric acid were used. Large applications of potash delayed maturity. Preliminary tests indicated that the time of application of sodium nitrate does not materially affect earliness except where the soil lacks nitrogen.

It was generally observed that Trice, Acala, Sugar Loaf, King, and Lightning Express started fruiting first; Trice, Acala, and Carolina Foster set fruit most rapidly during the early part of the season; and Carolina Foster, Sugar Loaf, Salisbury, Trice, and Cleveland set the most bolls per plant.

Pulling off the first squares apparently stimulated the growth of the plant and resulted in increased square formation, but there was a net loss in the number of bolls produced. Pruning squares either early in the season or later does not seem to influence either the rapidity with which the individual buds and bolls develop or the length of time between blooming and the opening of the boll. Studies from 1912 to 1916 showed that squares formed in June and early July develop more rapidly than those formed later, and bolls developed from the early squares mature sooner than those from later squares.

In both the Cleveland and Webber varieties the bolls reached their full size in 18 days. Data on rapidity of development suggest that bolls ought to be practically immune to weevil attack after they are from 12 to 14 days old. Studies on the resistance of bolls to puncture indicate that it would be difficult for weevils to penetrate the inner layer of the boll wall after about two weeks. According to determinations made by C. A. Ludwig, the Webber boll hardened more rapidly than the Cleveland boll.



Varietal leaders (E. S. R., 48, p. 629) in 1923 at the station were Lightning Express, a Cook strain, Acala, and Cleveland; at the Pee Dee Substation, Cleveland strains, Carolina Foster, College No. 1, and Mexican Big Boll; and at the Coast Substation, Cleveland and College No. 1.

[Cotton production under boll weevil conditions] (*South Carolina Sta. Circ.* 31 (1924), pp. 18-29).—These pages report practically the same information as noted above, together with recommendations for growing and poisoning the cotton crop in 1924. The recommendations of the Association of Southern Agricultural Workers (E. S. R., 50, p. 399) as to boll weevil control and cotton production measures for 1924 are appended.

The commercial classification of American cotton, A. W. PALMER (*U. S. Dept. Agr., Dept. Circ.* 278 (1924), pp. 35, pls. 4, figs. 19).—The elements and purpose of cotton classification are indicated, classifications according to grade, staple length, and character are explained, and the relation of classification to value is pointed out. Other topics dealt with include special conditions affecting the value of cotton, sampling and the handling of samples, and the influence of light and weather conditions on classing. A method of pulling staple is described and illustrated.

Winter flax, E. KREMER (*Faserforschung*, 3 (1923), No. 3, pp. 181-317, pls. 2, figs. 14).—Cultural methods employed with winter flax are detailed, and the use, morphology, and anatomy of the plant are described.

Pollination methods amongst the lesser millets, W. YOUNGMAN and S. C. ROY (*Agr. Jour. India*, 18 (1923), No. 6, pp. 580-583, figs. 6).—The pollination habits of *Panicum miliare*, sawan (*P. crus-galli frumentaceum*), and kodon (*Paspalum scrobiculatum*) are described.

Report of royal commission on prickly pear, B. D. STEELE ET AL. (*Brisbane: Govt.*, 1923, pp. [3]+48, pl. 1).—This report of the commission appointed to consider the prickly pear problem in Queensland discusses infested areas, dissemination, and past and suggested policies for control and eradication. See also an earlier report (E. S. R., 33, p. 134). The estimated infested area has increased from 15,806,429 acres in 1913 to 24,179,707 acres in 1923, or 837,328 acres per year during the decade.

Growing rye in the western half of the United States, J. H. MARTIN and R. W. SMITH (*U. S. Dept. Agr., Farmers' Bul.* 1358 (1923), pp. 19, figs. 9).—Cultural methods and field practices considered suitable for growing rye in the Western States are discussed, together with notes on the adaptation, varieties, uses, pests, and diseases of the crop, and on its place in the farming system.

The production of rye in the United States has increased rapidly during the past few years, due chiefly to a heavy foreign demand, high-priced labor, low yields of wheat, and the development of improved varieties of rye. While rye is grown largely as a cash grain crop in the western half of the United States, it is used also for pasture, as a green manure or nurse crop, and to smother weeds.

Quality and sugar content of some sugar beet varieties, C. A. FLORIÁN (*Ztschr. Zuckerindus. Čechoslovak. Repub.*, 47 (1923), No. 25, pp. 354, 355).—Beets with spreading foliage contained on the average 0.65 per cent more sugar than those with erect leaves, and beets with dark green foliage had 0.25 per cent more sugar than those with lighter leaves. Small beets had an average of 0.55 per cent more sugar than large beets, and short beets about 0.65 per cent more than longer ones. Small beets were less subject to climatic conditions than larger beets. Long roots endured drought better than the short ones. Beets with many fibrous roots usually averaged 0.9 per cent less sugar than the

normal beets. Beets with pronounced so-called sugar furrows contained an average of about 0.4 per cent more sugar than the other beets.

**Uba sugar cane and its sugar yields in Porto Rico**, F. A. L. DOMÍNGUEZ (*Porto Rico Dept. Agr. and Labor Sta. Bul. 28 (1923), Spanish ed., pp. 60*).—The origin, distribution, characteristics, and cultural qualities of Uba or Kavan-gire sugar cane are set forth, together with comparative yields and analyses of the juice at the station and at different factories on the island.

Results from several factories generally showed no difficulties in milling Uba cane or in elaborating the juice in making crude sugar. The normal extraction of the sucrose was lower than with cane of ordinary varieties. The losses of sucrose in bagasse are low, and the losses in the elaboration of the juice are about normal. The higher fiber content makes the bagasse from Uba of higher calorific value than that from ordinary sugar cane. On account of the low sucrose content of its juice, Uba can not displace the varieties now grown on the island. However, its resistance and immunity to diseases attacking sugar cane, economical cultural qualities, and adaptation to poor soils in the cane areas have led the author to believe that this variety, if given proper trial and study, will prove an important factor in the further development of the sugar industry.

**[Sugar cane experiments in British Guiana, 1921–22]**, J. CRABTREE, J. B. HARRISON, and C. L. C. BOURNE (*Jour. Bd. Agr. Brit. Guiana, 16 (1923), No. 3, pp. 123–143*).—The production of seedling canes and tests of green manure crops are described, and the principal varieties of sugar cane under cultivation in the colony in 1921, 1922, and 1923 are listed. Earlier work has been noted (*E. S. R.*, 50, p. 134).

**The cultivation of sugar cane in Java**, R. A. QUINTUS (*London: Norman Rodger, 1923, pp. XII+164, pls. 39, figs. 31*).—Part 1 of this treatise deals with conditions in Java and the theory of cane cultivation, discussing at some length soils; fertilizers; the morphology, physiology, functions, varieties, and diseases of sugar cane; and correlations in yields. Part 2 discusses the practice of cane cultivation, embracing classification of soils; cultural and field practices; pest control; determination of maturity; conducting cultural experiments; harvesting and transporting cane; management and costs; and statistics of the industry.

**Advantage of limiting the number of flowers for tobacco seed**, E. M. DE CALVINO (*Rev. Agr., Com. y Trab. [Cuba], 6 (1923), No. 10–11, pp. 38–40*).—Capsules harvested from tobacco plants with 5, 10, 20, and 40 flowers, with only the central spike, and with the whole inflorescence, had respective average weights of 0.439, 0.388, 0.366, 0.231, 0.23, and 0.19 gm. The weight per 1,000 seed amounted to 129, 121, 109, 105, 80, and 79 mg., respectively. Germination took a similar trend.

**Sevier wheat**, G. STEWART (*Jour. Amer. Soc. Agron., 15 (1923), No. 10, pp. 385–392*).—Sevier wheat, discovered in Sevier County, Utah, seems to be an intermediate form between durum and common wheat, but it antedates in Utah the official introduction of durum into the United States. It grows as a spring wheat under irrigation and as a winter wheat on the dry farm. Clark, Martin, and Ball (*E. S. R.*, 49, p. 634) have apparently classified it correctly as having a spring habit, and yet it seems to be as winter hardy as Turkey. As found, it contained several distinct strains, certain of which seem to be resistant to black stem rust while others seem to be susceptible. In the opinion of the author, this wheat is principally durum in its characteristics but seems to have some common wheat qualities. The great diversity of baking quali-



ties also suggests a hybrid origin. Tabulations show the comparative yields, rust resistance, and milling and baking qualities of Sevier and other varieties grown in Utah.

**Climate and wheat yields at College Park, Md.,** W. J. SANDO (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 10, pp. 400-408, figs. 3).—A significant negative correlation has been found to exist between rainfall and the corrected yields of four varieties of winter wheat, Dietz Longberry, Mammoth Red, China, and Dawson, grown at the Maryland Experiment Station from 1909 to 1920, inclusive. In general, yields above normal are associated with subnormal rainfall for the months of March and May, giving indications of the importance of low rainfall during these months for the successful growth of the above varieties of winter wheat at the station. No definite relation seems to exist between yields of the varieties studied and other climatic factors such as snowfall, temperature, and sunshine. In only 4 of the 12 years were yields above the average. The records for the other 8 years reveal the possibility for improvement by the proper selection of wheat strains better adapted to the climate of the region.

**The yield of wheat in England during seven centuries,** M. WHITNEY (*Science*, 58 (1923), No. 1504 pp. 320-324, fig. 1).—In this contribution from the U. S. Department of Agriculture, the author considers that the low average yield of wheat in medieval times must be ascribed to the methods and to the system, rather than to any loss of plant food from the farm, and that the increased production of England to-day must be attributed to the methods, the system, and the higher average intelligence of the farmer.

**[Certified seed production in Virginia],** W. G. WYSOR ET AL. (*Va. Crop Improvement Assoc. Ann. Rpts.*, 1922, pp. 36, figs. 5; 2 (1923), pp. 98, figs. 17).—These publications describe the progress of seed certification in Virginia, detail the activities of the Virginia Crop Improvement Association, and discuss the requirements for the production of certified and registered seed, the inspection system, and marketing seed.

**Recent Indiana weeds,** A. A. HANSEN (*Ind. Acad. Sci. Proc.*, 38, (1922), pp. 293-295).—Plants known to be troublesome elsewhere but not previously recorded authoritatively as occurring in Indiana and plants not previously reported as troublesome weeds include perennial sow thistle, spotted knapweed (*Centaurea maculosa*), perennial peppergrass or hoary cress, Mexican clover (*Richardia scabra*), lawn pennywort, welshed thistle (*Carduus crispus*), western brome grass (*Bromus carinatus*), phacelia (*Phacelia purshii*), Bermuda grass, Johnson grass, gum plant (*Grindelia robusta*), and wild corn.

**Wild corn, a serious weed in Indiana,** A. A. HANSEN (*Ind. Acad. Sci. Proc.*, 38 (1922), pp. 295, 296).—Wild corn (*Andropogon sorghum drummondii*) is said to cause heavy losses to corn on overflow land along the Ohio and Wabash Rivers in Posey and Vanderburg Counties, Ind., and along the Ohio River in Henderson County, Ky. In Posey County the only successful control method practiced is thorough cultivation, including regular hoeing as soon as the weed is large enough to be recognized. Controlling the weed by crop rotation does not seem feasible, since corn is practically the only crop the farmers will grow on the overflow land. The introduction and acclimatization of the sorghum midge is considered a dangerous experiment, since the insect might attack the sorghum crop, which is worth about \$1,000,000 annually in Indiana. Wild corn is an annual, and it is possible that if all the plants were kept from seeding throughout a single season the pest would disappear, providing none of the seeds remained viable in the soil during the second winter.



## HORTICULTURE.

[Horticultural investigations at the Massachusetts Station], J. K. SHAW, A. P. FRENCH and B. D. DRAIN (*Massachusetts Sta. Rpt. 1922, pp. 10a-12a, 13a*).—Work at the Market Garden Field Station at Lexington indicated that the amount of manure ordinarily used by vegetable gardeners may, if supplemented by chemicals, be cut in half without detriment to the crop, reducing in some cases the cost of production. Second-year records on individual asparagus plants indicated that comparative production is fairly constant from year to year.

Bearing apple trees in cultivation failed to bloom as heavily or to set fruit as well or yield as well as similar trees in sod mulch receiving an application of nitrate of soda. A comparison of grass mulch plus nitrogen, on the one hand, with clover plus phosphorous and potash on the other, indicated that clover residues are not sufficient to offset the value of applied nitrogen, the trees under the clover system of management being, apparently, handicapped at the very start. Six-year-old pear trees growing in sod showed little if any response, as indicated by leaf color, to 300 lbs. of nitrate of soda used alone or in combination with 300 lbs. of acid phosphate and 200 lbs. of sulphate of potash per acre. However, the grass beneath the trees showed a prompt response to the fertilizers. Peach trees planted on a test field, the plats of which have a continuous fertilizer history of over 30 years, showed the need of both nitrogen and potash. The insignificance of phosphorus was shown by the fact that trees on plats which had received no phosphorus in 30 years failed to show any injury. In fact trees in acid phosphate plats were inferior to control trees, especially those growing on limed areas. Weight records upon 300 apple trees comprising a pruning experiment and dug in the spring of 1922 confirmed the general proposition that pruning decreases tree growth in direct relationship to its severity.

[Horticultural investigations at the South Carolina Station] (*South Carolina Sta. Rpt. 1923, pp. 49-51, 53, 54, figs. 2*).—Continuing the report of the preceding year (*E. S. R.*, 48, p. 639), data are presented for the 1923 season upon nitrate of soda tests with bearing peach trees. Measurements of the 1923 growth of 8-year-old Mayflower trees showed an average of 18.03 in. for trees receiving 6 lbs. of nitrate of soda, 13.46 in. for trees receiving 4 lbs., and 7.84 in. for trees receiving 2 lbs., while check trees averaged 6.09 in. Other trees fertilized in early spring with 2 lbs. and receiving another 2 lbs. when the fruit was half grown averaged a little over 11 in., about the same as other trees receiving an equal amount of nitrate, half applied in early spring and half after harvesting. In the case of 8-year-old Elberta trees, 6 lbs. of nitrate of soda resulted in an average growth of 17.48 in., as compared with 4.29 in. for the control trees. Contrary to the Mayflower results, Elberta trees receiving 2 lbs. in the spring and 2 lbs. when the fruit was half grown made larger growth than when the second 2 lbs. was applied after harvest. Trees receiving 4 lbs. of nitrate of soda and bearing a heavy crop made less growth than other trees receiving 3 lbs. but bearing a light crop.

Observations on 108 bunch grape varieties set in 1922 and 1923 showed excellent growth, the older vines averaging from 8 to 20 ft. and the younger from 2 to 10 ft. of new growth.

A fertilizer test with lettuce at the Pee Dee Substation in 1922 showed the largest heads, averaging 0.7 lb., to be produced on soil receiving 2 tons per acre of a 7-5-5 fertilizer. One ton of 7-5-5 fertilizer plus 200 lbs. nitrate of soda applied as a side application yielded the second largest heads. One ton of 7-5-5 alone yielded heads averaging 0.49 lb. On the no-fertilizer plat 30 per cent of the plants were injured by cold, and 22 per cent shot to seed prema-



turely. Only 7 per cent of the fertilized plants were injured by cold, and in only one instance, that of the 0.5 ton of 7-5-5 plat, did more than 10 per cent go to seed. Celery studies indicate that winter celery does best in the western and spring celery in the eastern part of the State.

[**Horticultural investigations at the Kentville, N. S., Experimental Station**], W. S. BLAIR (*Canada Expt. Farms, Kentville (N. S.) Sta. Rpt. Supt. 1922*, pp. 21-55, fig. 1).—This report is composed largely of statistical information regarding the results of varietal tests of fruits, vegetables, and flowers.

The thinning of Wagener apples resulted in a decided increase in the number of first-grade fruits. Comparative trials of dusts and sprays for the control of various apple pests led to the observation that dusting may, if properly done, prove as effective as spraying. During the 1922 season, apples dusted and sprayed with sulphur-containing materials were much brighter in appearance than those sprayed or dusted with copper sulphate. Examination of the fruits showed an average of 12.22 per cent of scab on dusted trees and 3.57 per cent on the sprayed trees. Insect injury was, however, somewhat less on the dusted trees.

**Seed stimulation, a new way to higher production**, W. GLEISBERG (*Deut. Obst. u. Gemüsebau Ztg., Woch. Ausg., 70 (1924), No. 4, pp. 28, 29*).—A report upon work conducted at the Proskau Plant Breeding Station, in which radish seeds of six varieties were immersed previous to planting for different lengths of time in a solution containing 15 per cent of magnesium chlorid and 15 per cent of magnesium sulphate.

Weights of the crop harvested from 50 seeds of each treatment showed a marked gain as a result of the immersion, the highest yields for the six treated lots averaging 226½ gm. as compared with 62½ gm. for untreated material. Two varieties were stimulated most by three hours' immersion and four varieties by two hours' immersion. Seed treated for three hours in pure water yielded more than twice that of the control lot. The results of the treatments consisted not only in increased leaf and root development, but also in increased germination.

Kohlrabi seed immersed for five hours in magnesium chlorid solution gave somewhat better germination than similar seed immersed in water for the same period, and weights of the above-ground part of the plants showed considerable gain as a result of the treatment, especially when plants were grown on limed soil.

**Common edible and poisonous mushrooms of Ontario**, R. E. STONE (*Ontario Dept. Agr. Bul. 303 (1923), pp. 48, figs. 61*).—This is a revised edition of a previously noted bulletin (E. S. R., 39, p. 445).

**Bridge grafting**, G. E. YERKES (*U. S. Dept. Agr., Farmers' Bul. 1369 (1923), pp. II+20, figs. 18*).—This illustrated publication, presenting detailed instructions for bridge grafting girdled fruit trees, is a revision of and supersedes Farmers' Bulletin 710 (E. S. R., 34, p. 833).

**Identification of varieties of fruit trees from leaf and other growth characters**, W. H. UPSHALL (*Sci. Agr., 4 (1924), No. 6, pp. 184-189, figs. 4*).—In the belief that the methods outlined by Shaw (E. S. R., 47, p. 641) for identifying nursery apple trees might be applicable to other fruit species, a careful study was made of peach varieties commonly grown in southern Ontario.

Leaves occurring about half way along the current season's growth were found most reliable as means of distinction between varieties. Yellow flesh was found to be associated with a substantial amount of yellow pigment in the leaves, while in the white flesh varieties this coloring was almost entirely lacking. Utilizing this color indicator and the difference in shape of leaf glands, the author was able to divide the varieties into four distinct groups.

The varieties within these groups were distinguished from one another by color of young shoots, manner of folding of the leaves, etc. It is emphasized that varieties should be studied as they occur naturally and not from pressed specimens, etc. Preliminary observations on pears and cherries indicate that these fruits may yield quite readily to a similar method of identification.

**Fruits in West Virginia, Kentucky, and Tennessee**, G. M. DARROW (*U. S. Dept. Agr. Bul. 1189 (1923), pp. 82, figs. 34*).—Information based upon actual field surveys is presented upon the fruit growing industry in West Virginia, Kentucky, and Tennessee, which area, on account of the varied topography, is subdivided into district fruit growing regions, the physical and pomological features of which are discussed in considerable detail by the author. It is pointed out that disease is a very important factor, especially in the southern part of the area, and it is urged, therefore, that resistant varieties be selected for planting. Because of the diversity of environments and conditions existing over the area, an unusually large number of varieties of all fruits are grown, and a considerable portion of the bulletin is devoted to their description.

**The influence of potassium upon the health of the grape and the quality of wine produced**, L. RAVAZ, G. VERGE, H. LAGATU, and L. MAUME (*Ann. École Natl. Agr. Montpellier, n. ser., 17 (1922), No. 4, pp. 280–306, pls. 2, figs. 4*).—Experiments carried on with the variety Grand Noir grown on Rupestris roots in a chalky soil rich in potassium showed that the application of a 22 per cent sylvinite had a very favorable effect on the vine, preventing the formation of red coloration in the leaves and increasing production by 60 per cent without diminishing the quality of the wine. Without further applications of sylvinite, the same vines the subsequent year showed no reddening of foliage, growth was increased 39 per cent, production 110 per cent, and the quality of the wine 12 to 13 per cent. Coincidentally, there was found an increased participation of potassium in the metabolism in all parts of the vine, most particularly in the fruit. Sulphate of potassium and chlorid of potassium did not give the same beneficial effects as the 22 per cent sylvinite. The maximum dosage used, namely, 500 gm. of sylvinite per plant, an equivalent of 2,200 kg. per hectare (about one ton per acre), resulted in no apparent injury to the plants.

**Embryo budding of the avocado**, K. RYERSON (*Jour. Heredity, 15 (1924), No. 1, pp. 33–37, figs. 4*).—An illustrated article describing a method of propagating the avocado, in which the newly started embryo of a sprouted seed is utilized as a bud.

**Investigations on the freezing of citrus fruit on trees**, L. A. HAWKINS (*Calif. Citrogr., 9 (1924), No. 5, p. 163, figs. 2*).—Following up laboratory studies, previously reported by Wright and Taylor (*E. S. R., 48, p. 730*), a preliminary report is presented upon experiments conducted in citrus orchards at Lamanda Park, Calif., where orange and lemon trees inclosed in small insulated structures were frozen by introducing air cooled below the freezing point. Thermoelectric readings taken upon fruits on various parts of the trees showed the freezing points of the navel orange to range between 26 and 28° F., that of Valencias between 26.5 and 28.3°, and that of the lemon from 27.7 to 29.5°. In respect to undercooling, the Valencia orange was found to undercool the most and the lemon the least of any of the citrus species used in the experiment.

**Bud selection as related to quantity production in the Washington navel orange**, A. D. SHAMEL, C. S. POMEROY, and R. E. CARYL (*Jour. Agr. Research [U. S.], 26 (1923), No. 7, pp. 319–322, pls. 2*).—In general continuation of earlier work (*E. S. R., 43, p. 440*), the authors present yield records taken on progeny trees propagated in 1915 from an unproductive and from a normal limb of a



tree of the Thomson strain of the Washington navel orange. During the initial three years of fruiting, three trees of unproductive parentage yielded a total of 5 oranges, while two trees of normal parentage yielded a total of 317 oranges. Other trees propagated from the above parent tree by the California Citrus Experiment Station behaved in a like manner, records for 1923 showing no production for trees grown from an unproductive limb and an average of 49 oranges per tree for those grown from a normal branch.

The authors believe that the results indicate that the capacity of citrus trees for producing fruit is a transmittable character, capable of perpetuation through bud propagation, and emphasize the necessity of careful bud selection on the part of nurserymen to avoid the propagation of undesirable and worthless strains.

**Olives**, I. TRIBOLET (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 5, pp. 443-463, figs. 15).—The olive growing industry is discussed in a comprehensive manner, information being presented relative to the botany, history, cultural requirements, and the manufacture and utilization of the product.

**Vegetative propagation of tea**, A. A. M. N. KEUCHENIUS (*Dept. Landb., Nijr. en Handel [Dutch East Indies], Meded. Proefsta. Thee*, Nos. 84, (1923), pp. 48, pls. 16, figs. 2; 85 (1923), pp. 16, pls. 16, fig. 1).—With the aid of abundant illustrations, information is given in No. 84 on various practices involved in the asexual propagation of the tea plant. An English summary is given in No. 85.

**How to grow roses**, R. PYLE (*West Grove, Pa.: Conard & Jones Co.*, 1923, 15. ed., rev. and enl., pp. 189, figs. 129).—A revised and enlarged edition of a previously noted work (*E. S. R.*, 49, p. 438).

**Beautifying the home grounds—for the smaller type**, E. M. LOWRY (*Colorado Sta. Bul.* 290 (1924), pp. 3-20, figs. 14).—This bulletin contains general information concerning the improvement of home grounds, discussing the proper arrangement of buildings, drives, and walks; flower and vegetable gardens; and play grounds. Directions are given for the preparation of lawns and the planting of trees, shrubs, and flowering plants, and lists of plant materials are presented.

**Trees and flowers of Yellowstone National Park**, F. E. A. THONE (*St. Paul: J. E. Haynes*, 1923, pp. 70, pls. 8, figs. 102).—An illustrated handbook.

## FORESTRY.

**Some results of experimental forest planting in northern California**, S. B. SHOW (*Ecology*, 5 (1924), No. 1, pp. 83-94).—In an effort to displace brush, which has occupied vast areas of potential forest land in northern California subsequent to the destruction of the original forests by fire, direct seeding failed, first, on account of the unusually large number of rodents present, and, second, on account of the long, hot, dry summers, which were too severe for the few surviving seedlings.

Observations on 3-year-old western yellow pine planted on a 2-year-old brush burn showed the highest survival in the full shade of young brush. Under similar shade conditions, better survival was noted on good than on inferior soil types. In 1913, a favorable year in respect to rain during the summer months, the survival of western yellow pine was but little affected by the amount of shade.

Tests with other species indicated that the need of shade decreases with increase in the drought resistance of the species planted. In the case of *Sequoia washingtonia*, a species very sensitive to lack of shade, every plant was lost in open planting.

Among plants of the same age, large sized individuals endured open exposure much better than did smaller specimens. In respect to density of shade, consistently better survival was noted in the shade of dense than of open brush. Poorly planted trees survived better when given abundant shade. In respect to height growth, those trees surrounded on four sides and above with brush made the greatest development.

The nipping of the terminal shoots by rodents was observed to be most prevalent in fall planted trees, and in respect to size, larger trees were less affected than were the smaller individuals. In time of planting tests with several species at the Feather River Forest Experiment Station, a consistent 5 to 7 per cent increase in survival was recorded in favor of spring as compared with fall planted trees.

**High lead and reproduction in pine stand**, E. N. MUNNS (*Timberman*, 25 (1923), No. 1, pp. 172, 174, figs. 3).—Studies conducted in representative pine areas in the California Sierras, where high-lead and low-lead logging had been practiced, showed 30 per cent greater damage to reproduction on the part of high-lead logging, a relation which is deemed especially significant in that the larger size and consequently more valuable reproduction suffered most severely. Correlated with higher absolute destruction on the part of the high-lead logging, there was noted an increased severity in injury to the surviving trees.

**Minimum requirements for reforestation**, P. Z. CAVERHILL (*Timberman*, 25 (1923), No. 1, pp. 82, 84).—An appeal to lumbermen to pay more attention to the removal of slash, the saving of seed trees, and the exclusion of fires subsequent to cutting. The need of deferring taxes upon forest land in order to encourage reforestation is also discussed.

**Reproduction with fire protection in the Adirondacks**, J. KITTREDGE, JR., and H. C. BELYEA (*Jour. Forestry*, 21 (1923), No. 8, pp. 784-787).—Examination of forest growth on 20 areas cut over at various dates from 1862 to 1920 and in no case subject to burning since cutting led to the conclusion that young growth is occupying the cut-over and unburned areas of the spruce slope type in the Adirondacks and will undoubtedly reclaim them to high forest stands of valuable species if fire is excluded. Birch and balsam in about equal numbers were found to be most abundant in the reproduction. Since the proportion of spruce in the new stands ranges only from 10 to 15 per cent, a much smaller quantity than was present before cutting, it is suggested that silvicultural practices be so developed as to encourage the spruce, a species which is in exceptional demand on account of its value for paper pulp and other forest products.

**Growth of white spruce in the Adirondacks**, A. B. RECKNAGEL (*Jour. Forestry*, 21 (1923), No. 8, pp. 794, 795).—Measurements taken on 279 white spruce trees ranging from 5 to 18 in. in diameter at breast height and from 31 to 59 ft. in height show that white spruce is capable, up to a diameter of 12 in., of making an annual volume growth of better than 5 per cent. This figure indicates that under identical conditions white spruce grows more rapidly than does red spruce, and, since it is of equal value to red spruce as a source of pulp and better adapted to nursery practice and planting, the author predicts that white spruce will become increasingly important in Adirondack silviculture.

**Forestry experiments [at the South Carolina Station]** (*South Carolina Sta. Rpt.* 1923, pp. 56-58, figs. 2).—Investigations conducted at the Coast Substation during the past 12 years in cooperation with the U. S. D. A. Forest Service, indicate that the slash pine is able to make a growth of from 10



to 14 ft. in 6 years. Apparently two crops of this pine can be grown during the life of an average person. The longleaf pine was the only species found able to survive annual burning over of the land and then only to the extent of a few scattering and generally weakened individuals. On the other hand, the exclusion of fires resulted in the natural and abundant reseedling of all the native pines.

**Investigations on oil palms**, A. A. L. RUTGERS (*Medan, Sumatra: Gen. Expt. Sta. Alg. Ver. Rubberplanters Oostkust Sumatra, 1922, pp. VI+125, pls. 19, figs. 4*).—This is a symposium on the present status of knowledge concerning the oil palm as grown in the Dutch East Indies.

**Latex and rubber of transplanted trees**, O. DE VRIES (*Arch. Rubbercult. Nederland. Indië, 7 (1923), No. 11, pp. 475-494*).—An examination of the latex obtained from trees transplanted following severe top and root pruning showed that the rubber content and the properties of the rubber suffered no significant changes as a result of this operation. In one case the quality of the rubber was apparently improved as a result of transplanting.

**Notes on the forests of Quebec**, G. C. PICHE (*Quebec: Dept. Lands and Forests, 1923, pp. 40, pl. 1*).—Information of a general nature is presented concerning the ownership of the forests, forest zones, lumber industry, reforestation, fire control, etc.

**Notes on forest resources of central Europe** (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform. Bul. 152 (1923), pp. II+16*).—This bulletin consists of reports from American consuls and Department of Commerce representatives on the extent, distribution, ownership, and general condition of forests and forest industries in Yugoslavia, Fiume, Saxony, Latvia, Poland, Danzig, and the Ukraine.

**Colonial woods**, H. LECOMTE (*Les Bois Coloniaux. Paris: Libr. Armand Colin, 1923, pp. IX+194, figs. 28*).—In this small handbook there are discussed the properties and anatomical characters of various French colonial woods which have a marketable value.

**Useful timbers of tropical America**, G. McCARTY (*Timberman, 25 (1923), No. 1, pp. 156-158, figs. 4*).—Excluding the well-known mahogany and Spanish cedar, descriptions are presented for the tree and wood characteristics of 14 tropical species utilized by the Panama Canal Commission in its work.

**A textbook on forest mensuration**, U. MÜLLER (*Lehrbuch der Holzmesskunde. Berlin: Paul Parey, 1923, 3. ed., rev., pp. XVI+416, figs. 126*).—A comprehensive text in which the science and practice of forest mensuration are covered in detail.

**Twelfth annual report of the State forester to the governor for the year ending December 31, 1922**, F. A. ELLIOTT (*Oreg. State Forester Ann. Rpt., 12 (1922), pp. 43, pl. 1, figs. 8*).—This is the usual administrative report (*E. S. R., 47, p. 346*).

**Progress report of forest administration in the Jammu and Kashmir State for the year 1921-22**, T. P. SINGH (*Jammu and Kashmir [India] Forest Admin. Rpt., 1921-22, pp. II+26+XLVII*).—This detailed report presents, as usual (*E. S. R., 49, p. 537*), a record of the year's activities in the administration and management of the State forests.

## DISEASES OF PLANTS.

**Plant diseases** (*South Carolina Sta. Rpt. 1923, pp. 46-48*).—Brief accounts are given of a number of plant diseases observed during the period covered by this report, as well as of experiments for the control of some of the more important ones.

A bacterial disease of English peas, a disease of mung beans, *Diplodia* boll rot of cotton, and a new stem blight of snap beans are reported.

Watermelon anthracnose and downy mildew of cucumbers and cantaloups yielded to thorough timely applications of Bordeaux mixture.

Preliminary experiments are said to indicate that sulphur will not control the common soil diseases of the sweet potato.

**Mosaic studies**, I. E. MELHUS (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 42).—The author reports that *Physalis longifolia* has been found to carry mosaic over winter and transmit it to tomatoes, peppers, potatoes, petunia, and several wild species of solanaceous plants. Stem tissues of mosaic-infected potatoes and tomatoes are reported to contain certain bacteria and other organisms not found in healthy stem tissue, and the presence of organisms in mosaic-infected tissue is often markedly constant and probably largely responsible for the marked dwarfing.

**Some physiological variations in strains of *Rhizopus nigricans***, L. L. HARTER and J. L. WEIMER (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 8, pp. 363-371).—The results are given of a study of cultures of *R. nigricans* isolated from 18 species of horticultural and other plants. All the forms were found to be about equally parasitic on sweet potatoes. With a single exception, a form isolated from the sweet potato, all strains had an optimum temperature for the germination of their spores of about 31° C. The optimum temperature for mycelial growth was found to be lower than that for spore germination. None of the strains produced a cell-wall-destroying enzyme in sufficient quantity to be detected by the methods used when grown in sweet potato decoction. With one exception, the acidity of the sweet potato decoction was decreased.

**A seedling blight caused by *Fusarium culmorum* leteius**, J. P. ROSE (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 28).—The author reports the above fungus was isolated consistently from diseased seedlings of wheat, oats, barley, and rye grass obtained from different parts of Oregon.

**Studies on *Septoria* diseases of cereals and certain grasses**, G. F. WEBER (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 44).—The author reports that investigations conducted at the Wisconsin Experiment Station on the *Septoria* diseases of cereals and certain grasses indicate that there are a number of closely related species on these hosts that differ only slightly in morphological character.

***Fusaria* of wheat and corn**, C. D. SHERBAKOFF (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 45).—Examinations made by the author of samples of wheat and corn seed are said to indicate that in Tennessee, as well as some other States, the most common *Fusarium* of wheat is *F. graminearum* (*Gibberella saubinetii*) and of corn *F. moniliforme*. In only a few instances was *F. graminearum* isolated from corn seed, and *F. moniliforme* was not common on wheat seed.

**Rye resistant to leaf rust, *Puccinia dispersa***, E. B. MAINS and C. E. LEIGHTY (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 33).—Seed from a volunteer plant of rye grown in 1920 are said to have produced plants showing different degrees of susceptibility to the leaf rust of rye when tested in the greenhouse. Heads of some of these plants were bagged, and the seed obtained were grown and inoculated with *P. dispersa*. The inoculated plants showed degrees of susceptibility from practically complete immunity to a very high degree of susceptibility.

**Experiments with Haskell's method, or the so-called dry formaldehyde treatment for the prevention of oat smut**, J. E. HOWITT and R. E. STONE (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 35, 36).—A summary is given of



four years' experiments for the control of oat smut by the dry formaldehyde method (E. S. R., 39, p. 248). The results are said to indicate that no smut occurred in crop from treated seed during the period covered by the experiments.

**Results of treating seed of spring wheat and oats with copper carbonate dust to prevent smut**, E. B. LAMBERT and D. L. BAILEY (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 36).—Treating Prelude wheat and Victory oats with copper carbonate dust at the rate of 2 oz. per bushel completely controlled smut in both crops.

**Fighting black stem rust of grains by eradicating the barberry**, N. F. THOMPSON and J. G. DICKSON (*Wisconsin Sta. Bul.* 357 (1923), pp. 28, figs. 15).—The relation of the common barberry (*Berberis vulgaris*) to the stem rust (*Puccinia graminis*) of cereals is pointed out, and an account is given of the distribution of the barberry and progress made on its eradication in Wisconsin.

**Progress of the barberry eradication campaign**, F. E. KEMPTON (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 33).—A brief account is given of the progress attained in the barberry eradication in 1922 in Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wyoming.

**The effect of rust infection upon the water requirement of wheat**, F. WEISS (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 31).—Wheat was grown to maturity in quartz sand cultures supplied with various combinations of mineral nutrients. Plants were inoculated with *Puccinia triticea* in one series and *P. graminis tritici* in a second. Rust infection of either type resulted in lowered water economy of the plant, whether the dry matter of tops or heads was considered. The addition of sodium chlorid or monobasic phosphate to a nutrient solution failed to modify the susceptibility of the host. Sodium nitrate resulted in readier infection, while potassium chlorid retarded infection. The addition of calcium chlorid and magnesium chlorid is said to have resulted in less ready and less severe infection.

**Black point of wheat**, N. S. EVANS (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 34).—Observations are said to have shown that a high percentage of durum wheats in the upper Mississippi Valley are infected by a species of *Helminthosporium* similar to *H. sativum*. Inoculation experiments were made, and it was shown that when the conditions for infection were favorable abundant black-pointed kernels resulted.

**Foot-rot disease of wheat in Kansas**, H. H. MCKINNEY and L. E. MELCHERS (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 27, 28).—A foot-rot disease of wheat is reported in several counties in Kansas, a disease resembling the true take-all but differing in several respects from the so-called take-all disease reported in Illinois and Indiana.

**The Helminthosporium disease of wheat and the influence of soil temperature on seedling infection**, H. H. MCKINNEY (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 28).—In continuation of previous investigations (E. S. R., 47, p. 247), the author reports the widespread distribution of *H. sativum* on winter and spring wheat throughout the important wheat districts of the United States. Inoculation experiments are said to have shown that the optimum temperature for infection lies between 26 and 28° C.

**Influence of soil temperature and moisture on infection of wheat seedlings by Helminthosporium sativum**, H. H. MCKINNEY (*Jour. Agr. Research* [U. S.], 26 (1923), No. 5, pp. 195–218, pls. 4, figs. 6).—Greenhouse and field experiments are reported of the study of the influence of soil temperatures and soil moistures on the infection of the subterranean parts of winter and spring wheat and barley plants by *H. sativum*.

The results of the experiments show that the *Helminthosporium* disease as it occurs on the underground parts of wheat and barley is influenced by soil temperature and soil moisture. In the greenhouse high soil moisture was found to favor the disease in two experiments, while in the third a combination of soil temperature with moisture indicated that high soil moisture is more favorable to the disease at temperatures of 24° C. and above. The optimum temperature was found to be unaltered by changes in soil moisture, while changes in soil temperature did seem to cause a rather regular shifting in the soil moisture optimum. Temperatures at or above 24° favored a high moisture optimum, while temperatures below 24° favored a low moisture optimum. Field experiments are said to indicate that there is a direct correlation between soil temperature and soil moisture and the development of the disease. Early-sown winter wheat was found more severely affected by the disease than late-sown winter wheat.

**Varietal resistance in winter wheat to the rosette disease,** R. W. WEBB, C. E. LEIGHTY, G. H. DUNGAN, and J. B. KENDRICK (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 6, pp. 261-270).—Following the suggestion of McKinney that certain varieties of wheat were resistant to rosette (*E. S. R.*, 49, p. 343), the authors tested more than 200 varieties and strains of winter wheat, the work being carried on cooperatively by the U. S. Department of Agriculture and the Indiana and Illinois Experiment Stations.

Lists are given of the susceptible and resistant varieties, and the authors state that rosette has been controlled in infested localities where immune varieties are grown. Some of the varieties tested were found to also be resistant to flag smut, and their introduction is recommended into regions where both diseases prevail.

**A hybrid bean resistant to anthracnose and to mosaic,** D. REDDICK (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 47).—Hybrids produced between two varieties of beans, one of which was resistant to a strain of *Colletotrichum lindemuthianum* and somewhat tolerant to mosaic and another that is immune to one strain and susceptible to another but immune to mosaic, have resulted in the sixth generation of strains that are immune or highly resistant to both diseases.

**A yeast parasitic on Lima beans,** S. A. WINGARD (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 47).—The presence of a species of *Nematospora* on the cotyledons of Lima beans is reported, and it is considered from the evidence that the yeast is parasitic.

**A new leaf spot of Kentucky blue grass caused by an undescribed species of *Helminthosporium*,** C. DRECHSLER (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 35).—A disease of Kentucky blue grass (*Poa pratensis*) is briefly described, and it is said to be caused by a parasite somewhat similar to *H. sativum*.

**Further notes on the occurrence of cabbage blackleg,** J. C. WALKER and W. B. TISDALE (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 43).—In a previous publication (*E. S. R.*, 44, p. 748) attention was called to the importance of rainfall for the development of blackleg. In the present publication a brief account is given of the results of growing cabbage seed at Madison, Wis., and at La Conner, Wash. At Madison the rainfall was comparatively heavy, while at La Conner it was light, and only a slight development of blackleg occurred at the latter place. This is believed to indicate the feasibility of growing cabbage seed free from blackleg in the Puget Sound region.

**Investigation of carrot blight,** W. S. KROUT (*Massachusetts Sta. Rpt. 1922*, p. 16a).—It is reported that a study of the etiology of this disease has shown



that it is due to a species of *Macrosporium*, and in the field considerable benefit was shown from spraying with Bordeaux mixture.

**Spraying and dusting for the bacterial and late blights of celery in western New York**, H. W. DYE and A. G. NEWHALL (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 48).—Comparative spraying and dusting experiments with Bordeaux mixture and copper lime dust for the control of celery blights caused by *Bacterium apii* and *Septoria petroselini apii* are said to show that both treatments appeared equally effective in controlling the blights.

**First progress report of yellows-resistant Golden Self-blanching celery**, G. H. COONS and R. NELSON (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 48).—The production of a strain of Golden Self-blanching celery resistant to yellows is reported.

**Further studies on mosaic, I**, B. T. DICKSON (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 42).—The author claims successful inoculations of various varieties of clover by the use of juice from mosaic-diseased specimens of red clover, and also by using the insect *Macrosiphum pisi* as a transfer agent.

**Further studies on mosaic, II**, B. T. DICKSON and G. P. McROSTIE (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 42).—Out of a study of 1,075 red clover plants the authors report that 47 per cent showed mosaic in September, 1920, and the same plants on June 30, 1921, showed 91 per cent positively infected. An investigation of the plants showed that the amount of seed produced, as well as the germination of the seed, was gradually reduced by the disease.

**Notes on cucurbit mosaic**, S. P. DOOLITTLE and M. N. WALKER (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 42, 43).—The authors report that the milkweed (*Asclepias syriaca*) is an important agency in overwintering mosaic. Practically all of the infected milkweed plants occurring in the neighborhood of cucumber fields showed evidence of primary infection. It is considered that the milkweed becomes infected from adjacent cucumber plants, and being a perennial acts as a center of infection in succeeding seasons.

**Cucumber black rot caused by *Mycosphaerella citrullina***, F. MEIER, C. DRECHSLER, and E. EDDY (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 43).—The authors report a rot on cucumbers shipped from Florida, the disease being attributed to *M. citrullina*.

**Net blotch of meadow fescue caused by an undescribed species of *Helminthosporium***, C. DRECHSLER (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 35).—*Festuca elatior* is reported from Maine, Massachusetts, Connecticut, New York, Maryland, and the District of Columbia infected by a species of *Helminthosporium* somewhat similar to *H. gramineum* in its spore characters, although the symptoms on the host are said to be very similar to those induced by *H. teres* on barley.

**The bottom-rot disease of western New York lettuce**, H. W. DYE (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 48).—The author claims that bottom rot caused by *Rhizoctonia* sp. is the most destructive disease of Boston head lettuce grown on New York muck land. No variety seems to possess any great degree of resistance, but crosses made between Romaine and Big Boston have resulted in hybrid plants which promise to escape bottom rot and to possess the Big Boston color and quality.

**Investigations of the methods of controlling lettuce drop**, A. V. OSMUN and W. S. KROUT (*Massachusetts Sta. Rpt. 1922*, p. 16a).—A study of the fungus *Sclerotinia libertiana* is said to have shown that the disease caused by it may be controlled with relatively little expense by treating infested soil with formaldehyde. A 1 to 100 solution applied to the surface of the soil at the rate of 1 gal. per square foot was found efficacious. It is claimed that the

treatment must begin in the seed bed to prevent infection of young plants before transplanting into the main greenhouse.

**Colletotrichum pisi on garden peas**, R. E. VAUGHAN and F. R. JONES (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 47, 48).—This fungus is said to cause severe injury to peas in Wisconsin. It was first found in 1912 and appeared again in 1921. The similarity of the symptoms produced by this fungus to those caused by *Ascochyta pisi* is believed to be an explanation as to why it has not been previously reported in the United States.

**The correlation of foliage-degeneration diseases of the Irish potato with variations of the tuber and sprout**, A. H. GILBERT (*Abs. Phytopathology*, 12 (1922), No. 1, p. 40).—As a result of three years' study at the Vermont Experiment Station, the author claims that tubers with spindling sprouts invariably produced either leaf roll plants or plants possessing both mosaic and leaf roll symptoms. Spindliness of sprout was often correlated with net necrosis. Every net necrosis tuber produced plants showing typical and advanced leaf roll, but not all leaf roll plants were from necrosis tubers. Well marked symptoms of both mosaic and leaf roll were observed on the same plant in a number of instances. No plants free from disease were secured from any eyes of leaf roll, mosaic, or net necrosis tubers. Tubers with apparently normal sprouts were found capable of producing plants that showed mild mosaic symptoms.

**Leak, a serious transit disease of potatoes**, G. K. K. LINK (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 38).—Field and market observations are said to have indicated that this disease is virtually coextensive with the potato crop of the United States, and that it is a serious factor in transit and in storage. It has been demonstrated that most cases of leak are caused by Pythium-like fungi, although a few cases due to *Rhizopus* spp. and *Mucor* spp. have been found.

**Testing seed potatoes for mosaic and leaf roll, II**, F. M. BLODGETT, K. FERNOW, and F. R. PERRY (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 40, 41).—In a previous publication (*E. S. R.*, 47, p. 353) a description was given of a method for testing seed potatoes to determine the presence of mosaic and leaf roll. This work was continued, and practically all potatoes that were determined as affected with mosaic failed to show symptoms of the disease under the conditions prevailing in New York State during the year. This is thought to indicate the general unreliability of counts made on mosaic and the impossibility of removing mosaic plants by roguing under such conditions. From two lots of seed containing about 50 per cent of leaf roll, all but 3 per cent were removed by the methods described.

**The relation of time and temperature to the killing of potatoes and potato mosaic virus**, F. M. BLODGETT (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 40).—Experiments are reported of Bliss Triumph potatoes from plants affected with mosaic that were treated in water at temperatures from 35 to 80° C. (95 to 176° F.) for the purpose of determining the relation of time and temperature to the killing of the potatoes and the mosaic virus. The results obtained indicate that in the range of temperature used the time necessary for the killing of the mosaic virus was longer than that for the killing of the potatoes.

**Root knot**, J. R. WATSON (*Florida Sta. Bul.* 169 (1923), pp. 159-163, fig. 1).—The effect of *Heterodera radiculicola*, the cause of root knot on potatoes, is described. For the control of nematode injury the author recommends eradication of nematodes by clean summer cultures or the growing of bush velvet beans coupled with clean culture. The velvet beans are said to be not subject to attack, and as good results have been secured by growing them for one season



with frequent cultivation during the summer as have been secured by growing other resistant crops for two or three seasons in succession.

**Skin spot: A stage of powdery scab**, M. SHAPOVALOV (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 37, 38).—The skin-spot disease of potatoes reported from England, Canada, and Germany is said to have characteristics which are identical with those of the immature or closed-sorus stage of powdery scab. Isolations made by the author from the material obtained from various countries showed that the fungi invading the skin-spot pustules varied with the locality.

**Further experiments with inoculated and uninoculated sulphur for the control of potato scab**, W. H. MARTIN (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 38, 39).—Field experiments conducted with sulphur in 1921 are said to have resulted in a considerable reduction in the number of unsalable scabby potatoes. Where 600 lbs. of uninoculated sulphur was used 33.5 per cent of the tubers produced were marketable, as compared with 50.9 per cent of those treated with a similar amount of inoculated sulphur.

**Transmission of potato streak**, E. S. SCHULTZ and D. FOLSOM (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 41).—Preliminary observations in north-eastern Maine are said to indicate that streak is closely related to mosaic and similar diseases of the potato. Juice from an infected plant applied to mutilated potato plants caused infection in about 12 days, while control hills remained healthy. In similar series of experiments juice from curly dwarf plants produced mosaic dwarf infection in the case of one variety, while juice from mosaic plants of another variety caused mosaic symptoms in the upper leaves only.

**Potato tipburn in northeastern Maine**, D. FOLSOM and E. S. SCHULTZ (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 36, 37).—A form of tipburn is described that was observed in Aroostook County, Me., during hot, dry summers. The hopper burn type of disease was not observed, and the insect (*Empoasca mali*) which is responsible for hopper burn was very scarce. The type of disease described is said to usually appear within two or three hours of hot winds and bright sunlight following several days of cloudiness and rain. This type of disease was severe in fields and plats well sprayed with Bordeaux mixture and on plats and hills that were affected with leaf roll, mosaic, and related diseases. It is thought possible that hopper burn, especially the systemic type reported from the Middle West, may sometimes be involved with mosaic and other degeneration diseases, of which the typical symptoms are modified by the climatic conditions that favor leaf hoppers.

**Leaf hopper injury of potatoes**, J. G. LEACH (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 37).—The author reports observing during the summer of 1921 a pathological condition of potatoes in Minnesota, in which there was a pronounced shortening of the leaf petioles and crowding of the leaflets. The leaf hopper is said to have been very abundant and constantly associated with the disease.

**Progress notes on potato wart disease investigations**, F. WEISS and C. R. ORTON (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 38).—In connection with experiments for the control of potato wart disease the authors report several additional varieties of American potatoes that are provisionally classed as immune. Inoculation experiments have thus far shown that only the potato and tomato serve as hosts for this fungus. Immunity to wart disease was found not to be affected by the presence of leaf roll or mosaic.

**Yellow dwarf of potatoes**, M. F. BARRUS and C. CHUPP (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 39).—A hitherto undescribed disease of potatoes called yellow dwarf has been observed in New York. The plants are dwarfed

and the foliage yellowed, and in addition there is a necrosis of the pith and cortical cells in the vicinity of the upper nodes of the stalk. Tubers from affected plants are usually small, irregular, and often badly cracked. A dry rot from the stem end frequently occurs on badly affected tubers. The causal agent of the disease has not been determined.

**Potato diseases**, G. F. WEBER (*Florida Sta. Bul.* 169 (1923). pp. 101-148, figs. 41).—Brief accounts are given of diseases of potatoes observed in Florida and of the results of experiments for their control by spraying and dusting in 1922-23, and on the use of certified seed tubers. A number of diseases not known to occur in Florida are also described in order to familiarize growers with their symptoms.

**Potato seed treatment**, A. K. GARDNER (*Maine Agr. Col. Ext. Circ.* 86 (1923), pp. 4, figs. 3).—Potato seed treating demonstrations are described as conducted in Penobscot and Piscataquis Counties in 1922 and in Penobscot, Piscataquis, and Somerset Counties in 1923. The treated areas averaged 45 bu. in 1922 and 29 bu. in 1923 higher than did the untreated areas. Directions are given for seed disinfection with corrosive sublimate.

**Potato seed treatments in Western States**, H. G. MACMILLAN (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 39).—The author states that upon certain types of alkaline soils treating potatoes with corrosive sublimate does not give beneficial results, and in some cases positive harm was due to the treatment. Formaldehyde is also said to be noneffectual against scab under irrigation.

**Additions of formalin to maintain the concentration uniform with direct steam heat in the hot formaldehyde treatment of potatoes**, F. M. BLODGETT and F. R. PERRY (*Abs. in Phytopathology*, 12 (1922) No. 1, p. 39).—In experiments with a tank containing about 580 gal. that was heated by a direct discharge of steam, it was found that 0.9 pint of formalin was needed for every 50 bu. of tubers treated in order to keep the concentration to a uniform standard.

**Potato spraying-dusting**, A. V. OSMUN and P. J. ANDERSON (*Massachusetts Sta. Rpt.* 1922, p. 17a).—A report is made of comparative tests of homemade Bordeaux mixture and copper lime dusts for combating late blight and other leaf diseases of the potato. As a result of the first year's experiments dusting with hand dusters did not appear as efficient as spraying with a power sprayer, and it cost considerably more. Both spraying and dusting resulted in considerable increase in yields over the check, spraying giving the greater increase. The percentage of rotten potatoes is said to have been higher in the treated plats than on the check ones, and this is thought to be due to the fact that the vines on the check plats dried earlier and moisture conditions were less favorable for the development of the disease.

**The sesame spot disease of rice**, G. O. OCFEMIA (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 34).—The author reports noting in the Philippines rice seedlings being killed by *Helminthosporium oryzae*, a serious seedling blight being caused. The leaves are also subject to attack. It is stated that hot-water seed treatment has proved successful for the control of the disease in Japan.

**Sunflower rust**, D. L. BAILEY (*Minnesota Sta. Tech. Bul.* 16 (1923), pp. 3-31, pls. 3).—The rust of sunflowers (*Puccinia helianthi*) is said to have assumed economic importance when sunflowers began to be grown for silage purposes, and it is thought by the author that the occurrence of this rust may be a limiting factor in the cultivation of sunflowers if control measures are not discovered. All stages of the rust are said to occur on the sunflowers, and there is some indication of three or four biological forms of the fungus.

The temperature and other relations of the different stages of the fungus are described, and it is claimed that light is essential to the development of the



rust. Reduced light increases the length of the incubation period from six to eight days and may prolong it indefinitely. The rust was found not to develop at temperatures below 50° F., but if infection had already taken place the mycelium would remain dormant in the leaves for a month at this temperature and quickly develop with the return of higher temperatures. The rust from four of the most commonly occurring wild varieties of sunflower (*Helianthus scaberrimus*, *H. annuus*, *H. subrhomboideus*, and *H. maximiliani*) was found to readily infect cultivated sunflowers.

Investigations of the author indicate that sunflower rust can not be controlled nor can the severity of its attack be modified greatly by the fertilizers used, and there is said to be some indication that defoliation resulting from a rust attack is more severe on plants fertilized with nitrates. Spraying with Bordeaux mixture and dusting with copper carbonate powder were ineffective in controlling the rust in one year's experiment.

**Investigations on *Puccinia helianthi***, D. L. BAILEY (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 44).—Urediniospores from several wild species of sunflowers were said to have heavily infected the cultivated sunflower in 1920. In later investigations the same cultures on horticultural and cultivated varieties showed that the Mammoth Russian was resistant to collections of rust from some species, and a collection from *Helianthus tuberosus* gave two types of infection, one susceptible and the other resistant.

**Overwintering of tomato mosaic**, M. W. GARDNER and J. B. KENDRICK (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 41, 42).—In a study of mosaic tomato plants no evidence of seed transmission has been obtained. Investigations of old tomato fields have shown that the causal agent is carried over in the root stalks of perennial solanaceous weeds. An examination of specimens of *Physalis* showed a high percentage of mosaic plants in succeeding years after the appearance of the disease on tomatoes. The most destructive type of tomato mosaic is considered to be of plant-bed origin, and the presence of *Physalis* near plant beds is believed to be especially dangerous.

**Experiments with winter blight or streak of tomatoes**, R. E. STONE and J. E. HOWITT (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 41).—In a previous publication (E. S. R., 36, p. 350) a brief account was given of a disease of tomatoes grown under glass in Ontario. Subsequent work has confirmed the preliminary conclusions that the trouble is due to unsuitable soil conditions. Satisfactory results have been obtained in the control of this disease by the addition of phosphoric acid and potash to the soil.

**Two diseases of udo (*Aralia cordata*)**, J. L. WEIMER (*Jour. Agr. Research* [U. S.], 26 (1923), No. 6, pp. 271-278, pls. 4).—Descriptions are given of a root rot and a wilt of udo, a Japanese food plant introduced for growing in this country. The root rot is caused by a fungus similar to or identical with *Sclerotinia libertiana*, and the wilt is caused by *Verticillium alboatrum*.

**Apple disease control investigations**, W. S. KROUT (*Massachusetts Sta. Rpt.* 1922, pp. 16a, 17a).—The work reported is confined almost entirely to an investigation of the control of apple scab. It was found that on the McIntosh apple, a very susceptible variety, protection could be secured by spraying with fungicides. The best results were obtained by the use of a 3-10-50 homemade Bordeaux mixture for the prepink and pink applications, followed by lime sulphur 1 to 50 for summer sprays.

Results from dusting are said to have been satisfactory, the best control being obtained with finely ground sulphur. Copper lime dust proved effective in controlling scab, but serious russetting of the fruit by this material is said to eliminate it as a possible fungicide for use as a summer application.



**A preliminary report on cross-inoculation experiments with strains of *Cladosporium* from stone fruits,** M. BENSAUDE and G. W. KEITT (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 46).—Cross-inoculation experiments are said to have shown that *Cladosporium* from the peach would infect the plum, and strains from the plum would infect the peach as well as some varieties of plum.

**Cranberry disease work,** H. J. FRANKLIN (*Massachusetts Sta. Rpt.* 1922, p. 17a).—In studying the diseases of cranberries the author determined that the method of picking known as water-raking was very harmful to the keeping qualities of the fruit. Storage tests also showed that picking during the heat of the day was harmful to the keeping of cranberries.

**Coconut bud rot in the Philippines,** O. A. REINKING (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 46, 47).—Investigations of coconut bud rot in the Philippines are said to have shown that it is caused by a species of *Phytophthora* similar to the *Phytophthora* producing the black rot and canker of cacao.

**A preliminary report on a serious twig blight of American elms,** F. DETMERS (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 47).—The occurrence is reported of a twig blight of elm due to *Poronidulus conchifer*.

**The effect of *Cronartium ribicola* upon *Ribes*,** L. H. PENNINGTON (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 45).—As a result of four years' observations in localities where *C. ribicola* is abundant, the author claims that the rust often seriously affects some species of *Ribes*, individual bushes having died after early defoliation for three successive seasons. In certain restricted localities, where there was a heavy infection of the pines, all specimens of *Ribes* have been killed. It is believed that early defoliation and the subsequent death of *Ribes* are both factors in the control of the disease upon pine. The destruction of *Ribes* by rust is believed to have led to error in determining the distance that infection has spread from *Ribes* to pine.

**Notes on *Cronartium ribicola*,** P. SPAULDING (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 46).—It is claimed that infected leaves of *Ribes nigrum* and *R. cynosbati* almost invariably roll the edges upward when drying. Telia collected on dead or dying leaves or on dead spots on living leaves, in the warm weather of September and October, did not germinate when collected, but those on active, green leaves from the same bushes germinated readily. Cold is said to stimulate germination of all the spores, and the maximum germination was secured on leaves exposed to and killed by frost or which have persisted on the bush until snow fell.

**Five molds and their penetration into wood,** E. GERRY (*Jour. Agr. Research* [U. S.], 26 (1923), No. 5, pp. 219–230, pls. 4).—On account of the necessity for knowing the effect of certain molds on timber, blocks of aspen, Sitka spruce, red oak, and white oak were inoculated with cultures of *Aspergillus niger*, *Ceratostomella* sp., *Monilia sitophila*, *Penicillium divaricatum*, and an unidentified form. After growing for two years in flasks the mycelium was found present in the center of the hardwood blocks. The penetration was chiefly through the natural openings, that is, vessel or tracheid cavities, in the case of *A. niger* and *Ceratostomella* sp. *M. sitophila* and *P. divaricatum* showed the greatest amount of development in the different wood elements and a marked tendency to traverse cell walls. The unidentified mold was found to have entered the wood fibers and parenchyma as well as the open vessels and resin passages.

The fact that certain molds may destroy cell-wall substance and that many produce a surface discoloration makes it desirable to prevent the occurrence of mold in material that is to be subjected to especially exacting uses.



## ECONOMIC ZOOLOGY—ENTOMOLOGY.

**The white snail (*Helix pisana*) at La Jolla, Calif.,** A. J. BASINGER (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 522-526).—This is an account of *H. pisana*, a European snail enemy of citrus which became established in California in 1918 as previously noted (*E. S. R.*, 41, p. 548), and the measures taken to eradicate it. Methods employed in eradication include clearing the ground of vegetation, flaming the cleared areas, the use of a poison bait of 1 part of calcium arsenate to 16 parts of bran, and hand picking. The results obtained are said to have been very effective, but few *H. pisana* being left after one year of eradication work.

**A refrigerator for shipping live insects,** J. N. SUMMERS (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 539-543, figs. 2).—This is a description of a refrigerator and shipping box found satisfactory for shipping imported parasites of the gipsy moth from foreign countries.

**The status of entomology in Porto Rico,** G. N. WOLCOTT (*Jour. Dept. Agr. and Labor Porto Rico*, 6 (1922), No. 2, pp. 11).—This is a review of the insect investigations and control work conducted in Porto Rico.

**Some aspects of biological control in Hawaii,** D. T. FULLAWAY (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 531-533).—This is a contribution from the Hawaiian Board of Agriculture and Forestry.

**What may we expect from biological control?** H. S. SMITH (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 506-511).—This is a contribution from the California Citrus Experiment Station.

“Biological control work has been subject to extremes of popular approval and disapproval. This is due to a lack of understanding on the part of the general public of just what results may reasonably be expected from this method. Success is dependent upon biological principles with which the grower is not always familiar. Some insect pests are favorable subjects for attack by this method, and others are not. It is pointed out that the proper co-relation between host and parasite and freedom from secondary parasites are important factors in this type of control. The future is bright for this branch of economic entomology.”

**The history of hydrocyanic acid gas fumigation as an index to progress in economic entomology,** R. S. WOGLUM (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 518-521).—Hydrocyanic acid gas fumigation was discovered in 1886. From 1886 to 1893 it underwent decided improvement as a fumigant for citrus trees; from 1893 to 1900 greenhouse, nursery stock, stored products, and mill fumigation were introduced; during 1907 and 1908 orchard fumigation was standardized; from 1910 to 1913 sodium cyanid displaced potassium cyanid; in 1912 the portable machine generator was invented; during 1913 and 1914 vacuum fumigation was developed; in 1916 liquid hydrocyanic acid was first used for fumigating; and in 1923 calcium cyanid dust was experimented with as a fumigant.

**A simplified method for making lubricating oil emulsions,** A. M. BURGESS and W. M. GRUBE (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 534-539).—“A method is described by which stock emulsions of paraffin oils used in spraying are made without heat and without the use of potash fish oil soap. Freshly made Bordeaux mixture or copperas lime mixture, calcium caseinate, saponin, and other substances were used as emulsifying agents in the place of soap. The oil, water, and emulsifying agent were placed together in a container and pumped twice under fairly high pressure. The emulsions made in this way were used successfully on a large scale. They gave as good results against San José scale as the emulsions made with potash fish oil soap and were



cheaper and easier to prepare. These emulsions did not break down in the presence of hard water or water contaminated with lime or lime sulphur."

**Notes on nicotin dust progress**, R. E. CAMPBELL (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 497-505).—This is a general historical account by an agent of the U. S. D. A. Bureau of Entomology of the use of nicotin in dusts, with special reference to recent developments, the properties of carriers, the utilization of finely ground tobacco dust, the comparative merits of free nicotin and nicotin sulphate, the advisability of a certain amount of moisture, the mechanical devices for the application of dusts, data on self-mixing dusters, and the possibilities of local mixing. A bibliography of 50 titles is included.

**The relation between the volatility and toxicity of nicotin in sprays and dusts**, E. R. DE ONG (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 486-493, fig. 1).—This is a report of studies conducted at the University of California.

"Free nicotin is very volatile, while nicotin sulphate is nonvolatile. The toxicity of nicotin solutions varies in proportion to their conversion from the salt form to the free alkaloid. The volatilization curve of nicotin is almost an exact parallel of the curve of toxicity both of fumigation and spraying. Dust carriers follow this same law, i. e., an inert material does not free the nicotin as does an active carrier and hence is less efficient."

**Dusting cotton from airplanes**, B. R. COAD, E. JOHNSON, and G. L. McNEIL (*U. S. Dept. Agr. Bul.* 1204 (1924), pp. 40, figs. 19).—This is a summary of information on the airplane dusting of cotton, particularly for control of the boll weevil. The history of the use of airplanes in applying insecticide is first considered, followed by detailed accounts of dust hopper construction, field dusting studies, general considerations of airplane dusting, characteristics of airplanes used, and cost of operation.

"The studies which have been described are far from deciding on the practicability of using the airplane for applying insecticides, but they have shown that the dust can be blown down among the plants from the air above them, and that this dust can be made to adhere to the plants under daytime conditions when plane operation is feasible. The planes can be manipulated so that all portions of the field are treated. In fact, the cotton leaf-worm [*Alabama argillacea* Hübn.] was controlled with a poison allowance considerably below that necessary when using ordinary dust machines. Whether this application was sufficiently thorough to control the boll weevil is quite another question, since weevil control requires a much more thorough application than is necessary to control the leaf-worm, but all records bearing on this question appear to furnish decidedly favorable indications of success.

"Financially the use of the airplane does not seem to be out of the question, and in fact there is considerable possibility of pronounced economy as compared with the ground machines. It has the advantage of centralizing the control of the operation and placing it on a more skilled basis, which would undoubtedly greatly tend to increase the quality of the results secured. On the other hand, no farmer can afford to buy a single plane and figure on dusting his cotton, since it is not safe to place all of the eggs in one basket in this manner. Motors will go wrong, and cotton poisoning is an operation which can not be delayed when needed. The operation could be only considered as a community affair or for planters whose acreage would be large enough to justify purchasing more than one plane. In reality, to organize in safety, one plane should be provided in reserve for every one or two which are kept in flight.

"All of these are questions which can be worked out only by time and trial, but many districts in the South have now reached the point in public sentiment where the desirability of community weevil control can be seen, and it is



only by some such method as the use of the airplane that such community poisoning can be attempted in the near future."

**Insect enemies of the potato in Florida**, J. R. WATSON (*Florida Sta. Bul.* 169 (1923), pp. 149-159, figs. 13).—This is a brief account of the more common insect enemies of the potato in Florida, together with their control measures.

**Injurious and beneficial insects affecting the cranberry**, H. J. FRANKLIN (*Massachusetts Sta. Rpt.* 1922, p. 15a).—This is a summary of the more important results obtained during the year in work upon this project.

A very effective control for the root grub (*Amphicoma vulpina* Hentz.) was developed by soaking the soil with a solution of sodium cyanid. The author perfected a satisfactory control for the yellow-head fireworm by killing the moths with a spray of nicotin sulphate and soap in the dormant season. The experiments have shown that this pest can also be controlled with a lead arsenate spray used at the time and strength found to be more effective against the gipsy moth.

It was found that the red-striped fireworm (*Gelechia trialbamaculella* Cham.) can be controlled well with a nicotin sulphate and soap spray applied while the worms are in the tips of the vines.

Dusting with Nicodust to control the black-head fireworm (*Rhopobota naevana* Hüb.), though effective, was not practicable because of the expense. Experiments to discover a cheaper control gave negative results. A fungus, apparently a new species of *Entomophthora*, was found causing such an epidemic among this pest on one bog that it seemed an almost perfect control. The fungus was successfully cultured on fish. Important observations were made on the phenomenon of the occasional marked disappearance of black-head fireworm eggs while covered by the winter flood.

Many new facts were learned concerning the life histories of the minor cranberry pests *Cacoecia parallela* Rob., *Sparaganothis sulfureana* Clem., and *Noctua c-nigrum* L. The work of the cranberry fruit worm was observed to be light, although the egg parasite *Trichogramma minuta* was much less prevalent than normally. As the eggs of this pest hatched earlier than usual, the worms did little harm among stored berries. Further attempts to discover a practicable means of control by wetting the cocoons with chemicals during the dormant season resulted negatively.

**Investigations of insect enemies of the grape**, P. VOUKASSOVITCH (*Rev. Zool. Agr. et Appl.*, 22 (1923), Nos. 2, pp. 44-52; 4, pp. 111-120).—The polyphagy of *Oenophthira pilleriana* Schiff. is here considered at length.

**Spraying equipment for citrus trees in California**, F. B. HERBERT (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 494-497).—"There are two citrus districts in California, Tulare County with medium-sized open trees, where good results can be obtained with usual 4 h. p. spray machine, and southern California, with larger, denser trees, where the largest orchard sprayers (10 h. p.) are required. These machines have a capacity of 15 to 20 gal. per minute and carry 350 and more pounds pressure. Spray guns are used almost exclusively, with disk apertures ranging from  $\frac{7}{84}$  to  $\frac{9}{84}$  in. In Tulare County the average tree requires 8 to 10 gal. of solution, making a cost of 4 to 15 cts. per tree for the application, and in southern California requiring 12 to 15 gal., making the cost of applying run from 6 to 19 cts. per tree."

**Biological notes on the termites of the Canal Zone and adjoining parts of the Republic of Panama**, H. F. DIETZ and T. E. SNYDER (*Jour. Agr. Research* [U. S. ], 26 (1923), No. 7, pp. 279-302, pls. 8).—This is a report of observations and studies of the termites occurring in the Canal Zone, some of which have been the source of considerable damage. Twenty-one species of termites have been recorded from the Canal Zone and adjacent regions in



Panama, of which 15 occur on the Pacific and 10 on the Atlantic slope, but of these 8 are from both slopes. Specimens of all these species are in hand. A list is given of these termites, systematically arranged, in which their present known distribution in the Canal Zone and nearby parts of Panama is shown, and also a list of 22 references to the literature cited.

**Synopsis and catalogue of the Thysanoptera of North America, with a translation of Karny's keys to the genera of Thysanoptera and a bibliography of recent publications**, J. R. WATSON (*Florida Sta. Bul.* 168 (1923), pp. 100).—This is a synopsis of the Thysanoptera of North America, consisting of keys to the families and genera (pp. 6-24), followed by a catalogue of the Thysanoptera of North America, 335 in number (pp. 25-73), and descriptions of the new genus *Neoeurhynchothrips* and nine new forms. A bibliography of five pages and host and subject indexes are included.

**Red bug control in southern Pennsylvania**, J. R. STEAR (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 548-550).—This is a contribution from the Pennsylvania bureau of plant industry. The author has found that "the hatching period of the bright red bug, *Lygidea mendax*, in southern Pennsylvania comes so late in the blossom pink stage of nearly all varieties of apples that the pink spray is ineffective in control. A comparison of pink with the petal fall spray on the York Imperial, a late blooming variety, gave little difference in control. Two applications of nicotin gave no additional control. On earlier blooming varieties the petal fall spray would prove much more effective. One application of nicotin at petal fall is advised."

**A discussion of *Eutettix tenella* Bak. as a carrier of curly top of sugar beets**, C. F. STAHL and E. CARSNER (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 476-479).—Investigations by the U. S. D. A. Bureaus of Entomology and Plant Industry show that *E. tenella* is able under certain conditions to produce a systematic disease known as curly top in the sugar beet. "This ability is acquired by the insect after emerging from the egg as a result of feeding for only a short period upon a plant already diseased. After this feeding some time must elapse before the insect is able to transmit the virus to a healthy plant. This fact indicates that there may be a short incubation period for the virus in the insect. When once the ability to produce the disease is acquired there is no evidence to indicate that it is ever lost during the life of the insect. Although many insects of species other than *E. tenella* have been experimented with, not one has been found that is able to transmit the virus of curly top."

**Investigations of beet leafhopper (*Eutettix tenella* Bak.) in Salinas Valley of California**, H. H. P. SEVERIN (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 479-485).—This is an account of investigations conducted by the California Experiment Station. "The multiplication of the beet leafhopper (*E. tenella*) in the Salinas Valley occurs chiefly on sugar beets. The nymphs were bred from eggs deposited in 17 weeds growing in the cultivated areas. There was no evidence to show that a migration occurs from the San Joaquin into the Salinas Valley through the Coalinga-King City mountain pass. During the autumn dispersal the overwintering adults fly to the foothills, following the Salinas River and its tributaries. Early planting of sugar beets (December to February) is the only known practical method of preventing losses from curly leaf in localities outside of the fog belt. In the fog belt districts late planted beets make a better tonnage than early plantings in a normal season of rainfall. Planting should be discontinued from March 1 until after the spring dispersal. The limit of beet growing in the fog belt as far as curly leaf is concerned varies from 20 to 30 miles in California."

**The pink bollworm of *Thurberia*, *Thurberiphaga catalina***, J. L. WEBB (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 544-546).—This is a contribution from



the U. S. D. A. Bureau of Entomology. The noctuid *T. catalina*, which was found infesting Thurberia bolls in Arizona in 1913, and has been described by H. G. Dyar as a new genus and species under the name *T. catalina*,<sup>1</sup> constitutes a great menace to the cotton grown in the valleys of Arizona below the range of Thurberia. An account is given of the rearing of the adult, with notes on parasites of the larval stage. A list of other Thurberia insects collected is included.

**The results of infestation of chestnuts by *Carpocapsa splendana*, J. DUFRÉNOY** (*Rev. Zool. Agr. et Appl.*, 22 (1923), No. 5, pp. 143, 144, figs. 3).—A brief account of the attack of chestnuts by the larvae of this lepidopteran and of the invasion by fungi which follows.

**A dipterous leaf miner of *Salvia splendens* and two of its hymenopterous parasites in Argentina, J. BRÊTHES** (*Rev. Zool. Agr. et Appl.*, 22 (1923), No. 6, pp. 153–158, figs. 2).—Under the name *Phytomyza platensis*, the author describes a new agromyzid leaf miner of scarlet sage in Argentina which is closely related to the European species, *P. affinis*. A new parasite of this leaf miner is described as *Phytomyzophaga albipes* n. g. and n. sp. *Paracrias phytomyzae* is also noted.

**The Colorado potato beetle (*Leptinotarsa decemlineata* Say, J. FEYTAUD** (*Rev. Zool. Agr. et Appl.*, 21 (1922), Nos. 8, pp. 121–136, figs. 7; 9, pp. 137–150, figs. 5; 10, pp. 153–166, fig. 1).—The occurrence of this pest in France (E. S. R., 48, p. 856) is reported upon. Included in the account are descriptions of its several stages, its life history, and habits, injury, occurrence in America and Europe, natural enemies, and control measures.

**The Colorado potato beetle, P. MARCHAL** (*Rev. Zool. Agr. et Appl.*, 22 (1923), No. 7, pp. 177–191).—The appearance of this pest in France, as above reported, has led to this review of the history of its occurrence in the United States and a general discussion of means of control.

**Notes on the biology of *Desmorererus palliatus*, G. W. HERRICK** (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 546–548, pl. 1).—This is an account of observations at Ithaca, N. Y., of the cloaked knotty-horn beetle (*D. palliatus*), which lives on the common wild elder and attacks the golden elder used for ornamental purposes. The eggs have been found attached to leaves of the elder, but it is questionable if this is normal. The larvae bore into the stems of the elder just above and below the surface of the soil. Pupation takes place in the spring in the burrows in the stems, and the adults emerge during the last of May or early June. The beetles feed sparingly on the leaves before ovipositing.

**The successful introduction and establishment of the ladybird, *Scymnus binaevatus* Muls., in California, H. S. SMITH** (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 516–518).—This is a contribution from the California Citrus Experiment Station, in which it is stated that a South African ladybird, *S. binaevatus*, after several unsuccessful attempts has been colonized on several mealybugs throughout California. The prospects are that it will become of considerable value as a check on mealybugs.

**Spraying for the control of the logan beetle, G. S. PEREN** (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1922, pp. 62–66; also in *Jour. Pomol. and Hort. Sci.*, 3 (1922), No. 1, pp. 62–65).—The author finds that lead arsenate will control the logan beetle effectively if applied when the blossoms are one-third, two-thirds, and fully open.

**The banana root-borer, F. SEÍN, JR.** (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 82 (1923), Spanish ed., pp. 7, figs. 2).—This is a brief summary of informa-

<sup>1</sup> *Insecutor Inscitiae Menstruus*, 7 (1919), No. 10–12, p. 188.



tion on *Cosmopolites sordidus* Germ., which was first observed in the vicinity of Mavilla de Vega Alta in December, 1921, and has since been found at Corozal, Río Piedras, Comerio, Toa Baja, and in the vicinity of Sonadora de Aguas Buenas.

**Oak sapling borer, *Goes tessellatus* Hald., F. E. Brooks** (*Jour. Agr. Research* [U. S.], 26 (1923), No. 7, pp. 313-317, pls. 3).—This is a report based upon the author's observations during the last 10 years in several localities of central West Virginia, where rather extensive injury to young oak and chestnut trees was caused by cerambycid larvae of the species *G. tessellatus*. The injury consists of wide irregular burrows in the wood at the base of the trunks, trees from 0.5 to 2 in. in diameter suffering most. Approximately 25 per cent of the infested trees die from injury inflicted by the larvae or break a few inches above the ground at the large exit holes made by the escaping beetles. Observations of the life history of the pest and technical descriptions of its life stages, etc., are presented.

**Dusting and spraying peach trees after harvest for control of the plum curculio, O. I. Snapp and C. H. Alden** (*U. S. Dept. Agr. Bul.* 1205 (1924), pp. 19, pls. 2, figs. 4).—This is a report of post-harvest dusting experiments conducted from 1919 to 1922 in commercial peach orchards in the South, with a view to determining whether effective work can be done in destroying adult curculios in the late summer or early fall, when for lack of fruit the beetles are forced to feed to a great extent on the foliage. During the seasons of 1921 and 1922 this work was conducted in the peach belt of Georgia in the vicinity of Fort Valley, where the curculio infestation for several years had been much more severe than elsewhere in the South. In view of the fact that the results obtained during these two seasons were more complete and confirmed the results of the work conducted in Mississippi during the two previous years, only the data for the 1921 and 1922 experiments are discussed in detail in this bulletin. Much of the data are presented in tabular and chart form.

It was found that post-harvest spraying and dusting decreased the number of beetles per plat. The chief benefit obtained lies in preventing the rapid increase of second-generation adults, which are emerging in numbers at that season of the year.

"In 1921 two post-harvest dustings decreased the number of beetles 6 per cent, whereas on the check plat during the same period there was an increase of 69.53 per cent. In 1922 one post-harvest application of spray decreased the beetles 40.91 per cent, and two dustings decreased the beetles 56 per cent, whereas during the same period there was an increase of 25 per cent on the check or untreated block. Mortality tests conducted in the insectary show that the dust is not effective after a period of two weeks. In 1921 there was a mortality of 98.89 per cent of the beetles confined from the plat that was dusted twice, a 65.56 per cent mortality from those collected from the plat dusted once, and only a 5.56 per cent mortality from those collected from the check or untreated plat. In 1922 there was a mortality of from 87 to 91.67 per cent of the beetles confined from the plats that were dusted or sprayed twice, an 81 per cent mortality from those collected from the plat sprayed once, and only a 7 per cent mortality from those collected from the check or untreated plat.

"Two applications are necessary for best results in controlling the curculio after harvest, making the first four weeks after the harvest of the latest variety of peaches and the second two weeks later. Post-harvest treatments are not advisable except in cases where the curculio infestation has been severe during the peach season. Post-harvest liquid spraying after the usual liquid spray schedule had been followed earlier in the season on the fruit resulted in severe burning of the foliage. Two post-harvest applications of a 10 per cent arsenate



of lead and 90 per cent hydrated lime dust can be used with safety and are recommended in cases where the curculio has been bad. In dusting peach trees after harvest for the curculio this dust should be used at the rate of about 0.2 lb. per tree. When used at that rate the dust can be applied for about 0.75 ct. per tree for each application."

**Boll weevil investigations in 1923** (*South Carolina Sta. Circ. 31 (1924)*, pp. 3-18, figs. 3; also in *Rpt. 1923*, pp. 18-29, figs. 3).—This is a report of work conducted in cooperation with the U. S. D. A. Bureau of Entomology in 1923, and in continuation of work previously noted (*E. S. R.*, 48, p. 652). An account is given of poison experiments in cages; field experiments with poisons in the central and eastern part of the State, the details of which are presented in tabular form; field experiments with poisons in the upper Piedmont; work with new poisons; dusting machinery; weevil hibernation; etc.

The Florida method (*E. S. R.*, 48, p. 254) was tested at seven places in the Coastal Plain area and at three places in the Piedmont section. Two of these tests showed large net losses for the areas where the squares were stripped off and the plants poisoned according to the Florida method. The other eight tests showed net gains for the Florida method varying from \$3.83 to \$28.74, with an average net gain of \$1.81 per acre when all 10 tests are considered. The 1-1-1 (calcium arsenate-molasses) mixtures gave better results than the Florida method.

"The results from this season's work show very clearly that after the plants get large enough to begin blooming freely, the only effective means of reducing weevil infestation is by the use of a dust cloud of calcium arsenate applied with a machine that thoroughly atomizes the dry dust and gives a blast that drives the material down through the cotton plant."

**Control of the boll weevil in Arkansas**, D. ISELY and W. J. BAERG (*Ark. Agr. Col. Ext. Circ. 162 (1924)*, pp. 7, fig. 1).—This is a brief discussion of the subject as related to conditions in Arkansas.

**Bees v. spraying**, R. W. DOANE (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 527-531).—This discussion is based upon observations under Californian conditions.

**Keeping bees in coffee plantations**, F. SEIN, JR. (*Porto Rico Dept. Agr. and Labor Sta. Circ. 79 (1923)*, *Spanish ed.*, p. 6, fig. 1).—This is a brief discussion of the manner and value of pollination by the honeybee, and of honey production.

**Diseases of bees**, P.-J. BALDENSPERGER (*Maladies des Abeilles. Paris: Libr. Spéciale Agricole, 1922*, pp. 27).—This is a discussion of bee diseases, and means for their control.

**Habrobracon juglandis** Ashm. as a parasite of *Plodia interpunctella* Hubn., E. R. DE ONG (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 550, 551).—This is a brief account of observations of the life history of *H. juglandis*, which is the most abundant and widely distributed parasite of the Indian meal moth in California.

**The present status of *Aphycus lounsburyi* How. in southern California**, H. M. ARMITAGE (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 511-516).—"In the 'uneven-hatch' areas secondary parasitism has precluded *A. lounsburyi* becoming, by itself, an adequate means of control of black scale, except, possibly, at irregular intervals. Eight hyperparasites are known to attack *Aphycus*, and three others are under suspicion. It is, however, of much value in the uneven-hatch areas as an aid to fumigation by evening up the hatch. In the interior or 'even-hatch' areas, low temperatures which cause retarded development of *Aphycus*, particularly in the pupal stage during the one short period when it might alone control the scale, prevent its doing so. *Aphycus*, with *Scutellista cyanea* and *Rhizobius ventralis*, completes a sequence of enemies attack-



ing the black scale, and this fact offers a possibility of control. The distribution of *A. lounsburyi* has been so complete, both with and without human agency, that it is safe to say there is hardly a citrus orchard, or for that matter of planting of ornamentals or growth of native shrubbery in southern California, infested with black scale in which it is not possible to find *Aphycus* or evidence of its work. In spite of the many factors operating to its disadvantage, it is without question a most valuable addition to the parasite fauna of California."

**Unusual damage to the floors of a house by a species of pemphredinid wasp, *Stigmus fulvicornis* Rohw.,** M. R. SMITH (*Jour. Econ. Ent.*, 16 (1923), No. 6, pp. 553, 554).—This is a report of injury caused by *S. fulvicornis* at Starkville, Miss.

### FOODS—HUMAN NUTRITION.

**Purin metabolism,** W. C. ROSE (*Physiol. Rev.*, 3 (1923), No. 4, pp. 544-602).—The topics considered in this review are purins of physiological interest, the chemistry of nucleic acids, the digestion of exogenous nucleic acids (nucleoproteins), the anabolism of purins, the catabolism of purins, the uric acid of the blood, and the effect of purin-free foods upon the output of endogenous uric acid. A bibliography of 336 titles is appended.

**Mineral metabolism in relation to acid-base equilibrium,** A. T. SHOHL (*Physiol. Rev.*, 3 (1923), No. 4, pp. 509-543).—This review of the literature on mineral metabolism is discussed under the topics acid-base requirements, acid-base metabolism, acid-base equilibrium in the body, and the effect of alkalis on metabolism. A bibliography of 242 titles is appended.

**Some observations in regard to growth-promoting substances of bacterial origin,** S. DAMON (*Jour. Biol. Chem.*, 56 (1923), No. 3, pp. 895-902, figs. 5).—In the work reported in this paper certain organisms to which have been attributed growth-promoting properties have been used as the sole source of vitamin B in feeding experiments with rats on an otherwise satisfactory diet. The organisms selected were *Bacillus adherens*, representing the group of aerobic spore formers; Friedländer's bacillus and Pfeiffer's bacillus, representing mucoid organisms of the *B. mucosus capsulatus* group; and the timothy grass bacillus known as *B. timothy 213*, representing the acid-fast bacteria.

Negative results were obtained with all these organisms with the exception of Pfeiffer's bacillus and the timothy grass bacillus, both of which in amounts equivalent to 5 per cent of the diet caused resumption of growth or maintained the animals at a constant weight. With 10 per cent of the timothy grass bacillus as the sole source of vitamin B, rapid and continuous growth resulted.

**The stability of vitamins,** H. JEPHCOTT (*Jour. State Med.*, 31 (1923), No. 10, pp. 471-476).—A review and discussion of the literature on the subject.

**Studies of the vitamin potency of cod liver oils.—II, The vitamin potency of "spring" cod liver oil,** A. D. HOLMES (*Jour. Metabolic Research*, 3 (1923), No. 3, pp. 393-398, figs. 2).—Using the same methods as in the previous study of the series (*E. S. R.*, 49, p. 461), the author has investigated the vitamin A content of cod liver oil freshly prepared from livers of cod caught at Rockport, Mass., in March. It is noted that the fish at this season of the year have practically no food in their alimentary tract and are apparently being maintained on their body reserves.

The constants of the oil obtained were specific gravity at 25° C. 0.9206, refractive index at 20° 1.4783, saponification value 191, iodine value 143.4, acid value 0.6223, and cold test (clouding points) 6°. The 5 rats used in testing the oil for its content of vitamin A received, respectively, 2.02, 4.04, 6.06, 8.08, and 10.10 mg. daily of the crude oil. All of these amounts furnished



sufficient vitamin A to induce normal growth. "These results indicate that cod liver oils from emaciated fish may be highly potent in vitamin A, but the data at present available show that cod liver oils obtained from plump cod fish have a higher vitamin potency than that obtained from emaciated fish."

**Studies of the vitamin potency of cod liver oils.—III, The potency of pollack liver oil—early summer oils, A. D. HOLMES** (*Jour. Metabolic Research*, 2 (1922), No. 3, pp. 361–365).—Continuing the above investigation, data are presented on the composition and vitamin A content of 2 samples of pollack oil prepared in the laboratory from the livers of emaciated and plump fish caught at Rockport, Mass., early in June and in the middle of July. The constants of the 2 oils were specific gravity at 25° C. 0.9221 and 0.9217 for the emaciated and plump fish, respectively, refractive index at 20° 1.4788 and 1.4788, saponification value 187.3 and 187.3, iodine value 155.2 and 155.4, acid value 7.92 and 0.9833, and cold test (clouding point) 12 and 6°. The oil from the emaciated fish was of a pronounced reddish color and from the plump fish of a straw-yellow color.

Four rats were used in the examination of the oil from the emaciated fish and 5 from the plump fish. The amounts of oil fed in the first series varied from approximately 2 to 7 mg. and in the second from 1 to 5 mg. In each series, the animals receiving the smallest amount did not grow at so rapid a rate as the others in the series, while no difference could be detected between the growth on the larger amounts. As judged by the limited data presented, 3.4 mg. of oil from the emaciated and 1 mg. from the plump fish supplied sufficient vitamin A for normal growth. Compared with the results reported in the previous paper, pollack liver oil contains slightly more vitamin A than cod liver oil obtained from fish of similar physical condition.

**The cod liver oil industry in Newfoundland, S. S. ZILVA and J. C. DRUMMOND** (*Jour. Soc. Chem. Indus.*, 42 (1923), No. 18, pp. 185T–188T).—The authors report an investigation of the cod liver oil industry of Newfoundland similar in its scope to the previously noted investigation of the industry in Norway (*E. S. R.*, 48, p. 64).

In comparison with conditions in Norway, it is stated that the Newfoundland oil is prepared almost entirely from the cod. The direct open kettle steam process is used almost entirely. A comparison of oil from the same source prepared in this way and also in a jacketed pan showed no difference in potency. The oils examined were of uniformly high potency as regards vitamin A. As tested by the method of Zilva and Miura (*E. S. R.*, 46, p. 806), from 1.3 to 1.6 mg. proved sufficient to cause resumption in growth in the experimental rats. These values are as high as the most active Finmarken and higher than most of the Lofoten oils examined. No significant differences in activity could be detected in a large number of samples coming from different localities at different seasons of the year.

**On the mode of action of vitamins, W. CRAMER** (*Lancet* [London], 1923, I, No. 21, pp. 1046–1050, figs. 6).—Descriptions, with illustrations, are given of the lesions observed in longitudinal sections of the small intestines of rats suffering from the effects of vitamin underfeeding as previously noted (*E. S. R.*, 50, p. 566), of a diet free from vitamin A, and of a diet free from vitamin B, respectively.

The most profound changes were in the intestines of the animals on the vitamin A-free diet. These showed atrophy of the villi, with necrosis in parts. In addition, a number of protozoa, particularly *Giardia intestinalis*, were found in the lumen of the intestine, together with larger numbers than usual of intestinal bacteria. These were noted particularly in the necrotic tips of the



villi. Attention is called to previous observations of similar changes in the intestine as a result of exposure to large doses of X-rays. This lesion is thought to furnish adequate explanation of the various effects of vitamin A deficiency, including cessation of growth, occurrence of bacterial infections, and decrease in the number of blood platelets. The atrophic condition of the intestine is thought to interfere with the absorption of food and to afford the intestinal bacteria a ready access to the tissues and blood stream. As the bacteria enter the blood stream, they tend to be agglutinated by the blood platelets which consequently decrease in number, with resulting thrombopenia. It is thought that the favorable action of cod liver oil or other rich sources of vitamin A may be due either to a direct stimulating effect on platelet formation or to the healing over of the intestinal epithelium and the arrest of the bacterial invasion. In this connection it is noted that light acts as a stimulus to the production of blood platelets.

The author concludes that the vitamins are food hormones in the sense that they have a drug-like stimulating action on the digestive tract, vitamin B on the lymph tissue and vitamin A on the intestinal mucosa.

**Studies on the fat-soluble growth-promoting factor,** H. GOLDBLATT and K. M. SOAMES (*Biochem. Jour.*, 17 (1923), No. 4-5, pp. 446-453, figs. 2).—In this study of the storage and synthesis of the fat-soluble growth-promoting vitamin in the body, two groups of young rats which had ceased to grow on a ration lacking in vitamin A were continued on this ration with the addition of 3 per cent of cod liver oil and 10 per cent of butter fat, respectively. After a period of from 2 to 4 months they were killed and their livers used as the sole source of vitamin A for other groups of rats which had been brought to a state of nutritive decline on the deficient diet. For comparison other rats were fed livers of rats which had ceased to grow on the deficient diet. The liver was selected as the organ in which the largest deposit of vitamin A would be found.

Normal growth resulted when 0.5 or 0.25 gm. of liver from the cod liver oil rats was used as the sole source of vitamin A and less rapid growth with 0.5 gm. of the liver of the butter fat rats. Growth was not resumed on 0.5 gm. of the liver of rats on the diet lacking in vitamin A. With 1 gm. of these livers irregular results were obtained.

The storage of vitamin A in the rats which had been used in the first series of experiments was then tested by using the livers of these animals as a source of the vitamin in a further series of experiments. The livers of the rats which had been fed the livers of rats receiving cod liver oil were found to contain sufficient vitamin A for prompt resumption of growth, but probably not for additional storage, as growth ceased promptly when the liver feeding was discontinued.

Rats which had ceased to gain in weight on the deficient diet, and whose livers, according to the results obtained in the first part of the study, must have contained no detectable amount of vitamin A, were irradiated with a mercury vapor quartz lamp for about 4 weeks or until they had again stopped gaining weight. The livers of 3 of these animals when fed in 0.5 gm. amounts caused a resumption of growth as great or greater than that caused by the same amount of the livers of the butter fat rats. In 3 other cases there was also resumption of growth but not to so great an extent.

No attempt is made to explain the source of the vitamin in the liver of the irradiated animals beyond the suggestion that it may have been mobilized from other parts of the body, nor to explain why after a time the irradiated animals ceased to grow while their livers were still capable of stimulating the growth of other animals.



In an appended note it is reported briefly that evidence has been obtained of a similar storage of the antirachitic vitamin in the livers of rats receiving cod liver oil.

The supplementary value of light rays to a diet graded in its content of fat-soluble organic factor, H. GOLDBLATT and K. M. SOAMES (*Biochem. Jour.*, 17 (1923), No. 4-5, pp. 622-629).—The investigation reported was planned to determine the minimal amount of vitamin A which, supplemented by light rays, can bring about normal growth in rats, as well as normal development and calcification of the bones. The same diets were used as in a previous investigation of the effect of grading the quantity of this vitamin on the development and calcification of the bones of rats (*E. S. R.*, 50, p. 264), with the exception that instead of incorporating 3 per cent of cod liver oil in the basal diet for the normal controls 200 mg. was administered by a pipette daily. This gave about half the amount of cod liver oil of the previous study, but an excess of the amount required for normal growth. Four litters of 12 rats each were used. From each litter 2 rats were put upon each of the 6 diets graded in content of vitamin A, and 1 of each pair was irradiated for 10 minutes daily at a distance of 60 cm.

The average final weight and average maximum gain in weight of the non-irradiated animals were roughly proportional to the amount of vitamin A in the diet. The irradiated rats on the 3 diets highest in vitamin A grew at a normal rate, on the next highest at slightly less than normal, and on the next 2 at considerably less than the normal rate, although better than the non-irradiated rats on the same diet. Similar differences were noted in the gross and microscopic structure of the bones and in their calcium content.

It is concluded that "light rays can not act as a substitute for the fat-soluble organic factor. When the latter is completely absent from the diet, irradiation, though it causes rats on that diet to grow much better and their bones to develop and calcify much better than nonirradiated controls, yet does not bring about absolute normality in either respect. The degree to which such rats approach the normal probably depends upon the pre-experimental store of fat-soluble organic factor which the animals possess."

The influence of the antenatal feeding of parent rats upon the number, weight, and composition of the young at birth, V. KORENCHESKY and M. CARR (*Biochem. Jour.*, 17 (1923), No. 4-5, pp. 597-599).—Data are reported on the average number, weight, and composition (calcium, phosphorus, and nitrogen) at birth of the young of 30 pairs of rats on diets rich and poor in vitamin A, the diets employed being the same as in an earlier study. (*E. S. R.*, 50, p. 63).

These data indicate that the diet of the father before conception has no influence upon the number, weight, or composition at birth of the young. The diet of the mother before conception and during pregnancy influences the number and the total, but not the individual, weight of the offspring. The litters of mothers on a diet rich in vitamin A and in calcium were larger in the total number and total weight and in the number born alive. No appreciable differences were noted in the H<sub>2</sub>O, Ca, P, and N content of the young as a result of the mother's previous diet.

It is thought that the difference previously noted in the composition of the skeleton of the young from 24 to 85 days after birth (*E. S. R.*, 50, p. 261) is due to the different degree of storage of vitamin A rather than of phosphorus and calcium in the fetuses. "The normal chemical composition shown to exist in fetuses born of mothers kept on a diet deficient in fat-soluble factor is in accord with the accepted belief that the maternal organism will as far as possible yield all the necessary substances to her offspring even by the sacri-



fice of her own tissues. However, in our experiments, the storage of these substances, though being sufficient at birth, did not suffice in the post-natal life of the offspring."

**The effects of vitamin deficient diets on the adrenalin equilibrium in the body**, L. GROSS (*Biochem. Jour.*, 17 (1923), No. 4-5, pp. 569-578).—In this reinvestigation of the question of the effect of vitamin deficiency upon the size of the adrenals and their content of adrenalin, the method employed differed from that of McCarrison (*E. S. R.*, 41, p. 264) and others in that deficiencies in the different vitamins were dealt with separately, the diet of the rats being complete in all other respects, and that the animals were examined in the early rather than the late stages of the deficiency. The results reported, which represent the averages from 350 glands obtained from 175 rats, include the weight in grams of the adrenal glands per 100 gm. of the highest and of the final weight of the rat and milligrams of adrenalin per gram of the adrenal gland and per 100 gm. of the highest and of the final body weight of the rats.

These figures show both an absolute and relative atrophy of the gland, which was most marked in the B and least in the A deficiency. The adrenalin content of the glands showed a relative increase per weight of gland in the rats on the vitamin B-deficient diet. When compared with the highest body weight there was a decrease on the B- and C-deficient diets, but when compared with the final body weight there was no change from normal, with the possible exception of a slight decrease on the C-deficient diet. The adrenalin content tended to remain constant following the removal of one of the glands and the injection of adrenalin. No definite differences could be found in the adrenalin content of the blood of the normal and the vitamin-deficient animals, nor were there any characteristic differences in the properties of the blood in regard to their effect on isolated organs.

It is concluded that pure vitamin deficiencies cause very little alteration in the adrenalin equilibrium in the adult rat if the animal is not brought to the point of death on the diet. The striking changes observed by others are thought to have been produced by the accompanying starvation rather than by the lack of vitamins.

A preliminary report is also included of a study of the carbohydrate metabolism on vitamin B-deficient diets. It is thought that there is as yet insufficient evidence to attribute to vitamin B deficiency a derangement of carbohydrate metabolism.

**Beriberi and rice neuritis**, M. NAGAYO (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 17, pp. 1435-1437).—This is a brief report of research work which has been conducted in Japan on the relation between human beriberi and the so-called polished rice disease of experimental animals. In the opinion of the author the diseases are not identical. Certain distinguishing clinical and anatomical features which are thought to furnish support to this view are discussed briefly. A condition which is considered to be identical with experimental polished rice disease is a form of malnutrition sometimes occurring among infants fed almost exclusively on carbohydrates (in Japan on solutions of polished rice powder). This condition is known in Germany as Mehl-nährschaden and in Japan as Chichiko dyspepsia.

**Fats in relation to the genesis of goiter**, R. McCARRISON (*Brit. Med. Jour.*, No. 3188 (1922), pp. 178-181, figs. 4).—This paper reports an extension of the study of the effects of certain fats on the thyroid glands of pigeons (*E. S. R.*, 44, p. 667) and a study of the growth and metamorphosis of tadpoles. The latter has been noted from a preliminary report (*E. S. R.*, 46, p. 565).

In the first study, involving the use of 28 pigeons, observations were made on the effect upon the thyroid gland of the feeding of free oleic acid as com-



pared with butter and with cod liver oil containing 0.002 per cent of iodine. Goiters were found among the controls and among the pigeons receiving oleic acid and butter, but not in those receiving cod liver oil. The fact that oleic acid was even more potent than butter in inducing goiter is thought to suggest the possibility that the harmful effect of butter is due to the presence in the digestive tract of free unsaturated fatty acids derived from butter. This might result in the absorption of iodine from the foods, thus rendering it unavailable for the thyroid gland.

In discussing in conclusion the general problems of goiter, the author expresses his opinion that "the composition of the food has an important bearing upon it; that the food must be considered both in relation to its content of available iodine and in relation to its content of fats; that the thyroid may enlarge not only from insufficient intake of iodine (a comparatively rare occurrence), but from relative insufficiency of iodine consequent on the presence of an excess of certain edible fats or of free fatty acid (oleic) in the digestive tract; that the food must be considered in relation not only to the normal processes of digestion but in relation to abnormal processes that may arise from the introduction of bacteria into the digestive tube; and that variations in histological types of goiter may result from variations in the composition of a goiter-inducing food.

**Pellagra prevention by diet among institutional inmates, J. GOLDBERGER, C. H. WARING, and W. F. TANNER** (*Pub. Health Rpts. [U. S.], 38 (1923), No. 41, pp. 2361-2368*).—This is a general summary of the study of the prevention of pellagra by diet conducted by the authors under the auspices of the U. S. Public Health Service. The investigation, which has led to the conclusion that protein or amino acid deficiency is the principle etiologic factor in pellagra, has been reported in greater detail in separate papers previously noted (*E. S. R.*, 48, p. 865).

**The calcium and phosphorus metabolism in rickets, with special reference to ultraviolet ray therapy, W. J. ORR, L. E. HOLT, L. WILKINS, and F. H. BOONE** (*Amer. Jour. Diseases Children, 26 (1923), No. 4, pp. 362-372*).—The literature on calcium and phosphorus metabolism in rickets is reviewed, and data are reported on a series of metabolism studies conducted on 3 infants with active rickets for periods of 4 days before and 4 days after an 8- to 11-day period of treatment with ultraviolet light. The data obtained included the intake of calcium and phosphorus and output of both in urine and feces and the content of inorganic phosphorus and calcium in the blood serum before and after treatment.

Before treatment the calcium and phosphorus balances were negative in 1 case and only slightly positive in the other 2. The ultraviolet light treatment increased the retention of both calcium and phosphorus. The treatment also had the result of increasing the percentage of phosphorus excreted in the urine as compared with the feces. The effect of the treatment on the partition of calcium excretion between urine and feces was not marked, in both cases the bulk being excreted in the feces. An increase in the amount of calcium in the urine was not accompanied by a decrease in the amount in the feces. The treatment increased both the calcium and phosphorus content of the blood serum.

"From these observations it seems justifiable to conclude that the ultraviolet rays act by increasing the absorption of calcium and phosphorus from the intestine. It appears likely that the absorption of these elements may occur in excess of the amounts which can be utilized for calcification. This slight excess is then excreted in the urine."

**Contribution to the study of experimental rickets in the rat,** LESNÉ, VAGLIANO, and CHRISTOU (*Rev. Path. Compar.*, 23 (1923), No. 237, pp. 561-567, pls. 6).—The work reported is essentially a repetition of the work of Sherman and Pappenheimer (*E. S. R.*, 45, p. 767) on the experimental production of rickets in rats by diets whose essential deficiency was in phosphorus alone.

## ANIMAL PRODUCTION.

**Farm livestock of Great Britain,** R. WALLACE and J. A. S. WATSON (*Edinburgh: Oliver & Boyd*, 1923, 5. ed., rev. and enl., pp. XX+868, pls. 232, figs. 112).—In this revised edition of the book previously noted (*E. S. R.*, 19, p. 1168) the chapters on the principles of breeding, Shorthorn cattle, house feeding of cattle, the Clydesdale horse, and feeding of sheep have been recast and amplified by the junior author, who also added a new chapter on wool. Other new chapters include one on goats, by H. S. Holmes-Pegler, and one on shoeing the foot, its injuries and diseases, by W. R. Davis. The material in the other chapters has been amplified to include the more recent developments in the different breeds of livestock and to conform to the more recent experimental results.

**The meat industry,** W. WOOD (*London and New York: Isaac Pitman & Sons, Ltd.*, [1923], pp. IX+98, pl. 1, figs. 12).—This book consists essentially of a brief review of the world's meat industry.

**Undernutrition in steers: Its relation to metabolism, digestion, and subsequent realimentation,** F. G. BENEDICT and E. G. RITZMAN (*Carnegie Inst. Wash. Pub.* 324 (1923), pp. VIII+333, pls. 3, figs. 37).—This is a complete and detailed account of metabolism experiments with steers receiving submaintenance rations of native hay, carried on at the New Hampshire Experiment Station in cooperation with the nutrition laboratory of the Carnegie Institution.

During 1918-19 12 steers were employed, equal numbers being 3, 4, and 5 years of age, respectively. The first 25 days (November 27 to December 22, 1918) consisted of a preliminary feeding period during which the ration required to maintain weight in each individual was determined. On December 22 the steers were divided into three groups, and group 1, consisting of 1 steer of each age, was continued on the maintenance ration until May 12, 1919. Group 2, consisting of 1 3-year-old and 2 steers each of the 4 and 5 year ages, received only 50 per cent of the maintenance ration until May 5, 1919. Group 3 included the poorest animals of each age and consisted of 2 3-year-olds, 1 4-year-old, and 1 5-year-old. This group received 66 per cent of the maintenance ration to February 7, followed by 40 per cent of the maintenance ration to May 5, 1919. Groups 2 and 3 again received the original maintenance ration from May 6 to May 12.

After this period the steers were redivided into lots for a study of the effect of the submaintenance feeding on the economy and rate of gains and finish made by the steers when given more ample rations. The 3-year-old from group 1 and 1 3-year-old and the 5-year-old from group 3 were pastured during the summer. Three 4-year-olds, one each from groups 1, 2, and 3, and 1 3-year-old from group 3 received a high protein grain mixture (linseed meal, cottonseed meal, and bran 1:1:1) with hay. One 5-year-old steer from group 2 was placed on a maintenance ration to July 7, after which he also received the high protein ration. One steer of each age from group 2 and 1 5-year-old from group 1 received a low protein grain mixture (wheat bran and corn meal 1:2) in addition to hay.



The animals were housed during the experiment in a stable, but were taken 300 meters (984 ft.) to the respiration chamber once weekly and were allowed exercise daily in a large bare lot until the middle of April.

Two other steers equal in weight and size to the 5-year-olds, but at least 1 year younger, were selected to conduct digestion and nitrogen balance trials from December 27, 1919, to December 17, 1920, under conditions which simulated those with the steers on the submaintenance rations during the previous year. The main difference in treatment of the two lots was that these animals were almost continuously confined to metabolism stalls. They were, however, started on maintenance rations which were decreased to submaintenance rations, followed by the fattening period before slaughter as with the submaintenance animals in the 1918-19 experiment.

Records of the gaseous metabolism of the steers on the different planes of nutrition were taken periodically in the 1918-19 trials in the respiratory chamber previously described (E. S. R., 44, p. 68). The basic determinations were made while the steers were standing with a minimum of muscular activity and 24 hours after ingestion of food, but comparative determinations were also made with some muscular activity going on and immediately after ingestion of food. Many other notes and observations were also taken on the animals such as live weight, body measurements, rectal and skin temperatures, pulse rate, relative muscular movement, slaughter records, and amounts and analyses of feed and water consumed. In the 1919-20 experiments with the 2 steers practically all the above data were recorded, and in addition the production of feces and urine was determined and analyses made. The data collected on each animal are reported and discussed for both experiments.

The very rapid increase in live weight made by the steers changed from a submaintenance to a full-maintenance ration and the daily fluctuations in body weight when on the same ration emphasized the importance of fill as a factor in modifying live weight. Irregularities in the amount of water consumed and the consistency and amount of feces produced also tended to affect the live weight, especially during the submaintenance periods. Reduction in heart girth occurred during the submaintenance periods, which remained fairly constant for several weeks after realimentation began. The digestibility of the hay was apparently not influenced by the amount of hay consumed or the plane of nutrition of the animal.

A study of the nitrogen balances showed that nitrogen equilibrium could not be maintained on the hay ration alone during the maintenance periods. Observations on the steers during submaintenance showed that there was a shrinkage of the paunch, a loss of luster in the hair, the skin became drier and tighter, the skin temperature was slightly lowered, the pulse rate was markedly lowered, and the animals moved around more slowly than the control steers, but they nevertheless showed a desire for exercise. The correlation between pulse rate and metabolism was very striking, as evidenced by the doubling of the pulse rate during the fattening periods. Submaintenance apparently did not influence rectal temperature. The records of gaseous metabolism indicated that muscular activity could increase the  $\text{CO}_2$  production a maximum of 55 per cent, whereas the ingestion of moderate amounts of hay produced no increase in  $\text{CO}_2$  during the first 1 or 2 hours. While standing, about 17 per cent more  $\text{CO}_2$  was produced than while lying.

The energy metabolism of all steers during the short maintenance period at the start was rather variable, but in general it was 2,140 calories per square meter of body surface for 24 hours. During the undermaintenance period



with group 1 this was nearer 1,820 calories, but during the latter part of February and the first part of March it dropped to 1,470 calories per square meter of body surface in 24 hours. During the submaintenance periods the metabolism was 1,460 calories for group 2 and 1,490 calories for group 3, and 1,670 calories per square meter of body surface for 24 hours for the 2 steers in 1919 during their entire submaintenance period. During fattening the daily metabolism per square meter of body surface was practically 2,200 calories for the submaintenance groups and 2,160 calories for the control group.

The resumption of the original metabolic level after submaintenance indicates that no injury to the ability to lay on flesh, physiological functions, or the economic utilization of metabolizable energy had occurred. It was computed from the 1919-20 experiments that the steers lost 1,300 gm. of nitrogen and about 52 kg. of body fat during a 140-day period on a ration supplying 50 per cent of the maintenance requirement.

**Wintering beef cattle** (*South Carolina Sta. Rpt. 1923, pp. 8, 9*).—During a 100-day wintering test, three lots of 9 yearling steers receiving the following rations made average daily gains as noted: 1 lb. cottonseed meal and 25 lbs. of corn silage 0.8 lb. gain, 3.31 lbs. of soaked velvet beans and 25 lbs. of corn silage 0.66 lb. gain, and 3.31 lbs. dry velvet beans and 25 lbs. of corn silage 0.93 lbs. gain. The average daily gains made by the steers in these lots during the following summer on Bermuda pasture were, respectively, 0.99, 1.04, and 1.03 lbs.

**Feeding experiments on draft cattle [I], II,** (*Philippine Agr., 8 (1919), No 3, pp. 79-91; 12 (1923), No. 5, pp. 173-179*).—The results of five feeding experiments with working bullocks, carried on at the University of the Philippines, are reported by F. P. Lago in the first paper. Animals receiving native pasture were found to make slightly better gains when receiving supplements of corn fodder as compared with sugar cane tops, guinea grass as compared with corn fodder, and corn fodder as compared with Japanese cane. Very little advantage was shown in feeding ear corn as a supplement to pasture. A comparison of Japanese cane and corn fodder as the sole rations indicated that they were about equal in value.

Three experiments are reported by A. C. Sanchez in part 2. In comparing 1 to 5 kg. of shelled corn, 4 to 11.6 kg. of guinea grass, and 1 to 1.5 kg. of copra meal per head daily as supplements to native pasture, with pasture alone for working bullocks, no advantage was found in feeding the supplements, as determined by the weights of the bullocks.

**[Feeding experiments with swine at the South Carolina Station]** (*South Carolina Sta. Rpt. 1923, pp. 9-11*).—Hogs receiving a 2 per cent corn ration with soy bean pasture for 36 days made average daily gains of 1.05 lbs. as compared with 0.8 lb. by hogs receiving corn and tankage in dry lot and 0.49 lb. by hogs receiving corn alone. During the following 110 days the first lot of hogs received rye pasture while the others were maintained on the same feeds. The average daily gains made during this period by the different lots were, respectively, 1.2, 1.22, and 0.24 lbs.

In a test of the feeding value of velvet beans alone and with corn, very unsatisfactory gains were made, but in another test average daily gains of 0.7 and 0.91 lbs. per day were made by hogs receiving shelled corn and dry velvet beans and shelled corn and soaked velvet beans, respectively, when self-fed. This, however, was not as good or as economical as feeding corn and tankage.

In comparing the gains made on forages at the Pee Dee substation, five lots of 10 pigs each were placed on peanuts or sweet potatoes combined with corn



or tankage, and one lot was allowed both peanuts and sweet potatoes. Peanuts and corn and peanuts and sweet potatoes produced the largest and most economical gains, while sweet potatoes alone were the most unsatisfactory. At the conclusion of this test the hogs made average daily gains on different forages as follows: 1.1 lbs. on standing corn and tankage, 1.24 on standing corn and velvet beans and tankage, 0.73 on standing corn alone, 0.52 on standing corn and velvet beans, and 1.67 lbs. on corn and tankage fed in dry lot.

**Feed requirements for fattening pigs,** N. HANSSON (*Landtmannen*, 6 (1923), No. 34, pp. 593, 594, fig. 2).—This is a brief report of a composite study of the feed required to produce gains in the pigs used in previous fattening experiments at the Central Experiment Station near Stockholm. The work is based on results with 1,758 pigs. The following table gives a summary of the feed required to produce gains in the pigs of different weights:

*Summary of feed requirements of fattening swine of different weights.*

Live weight class.	Daily average per animal.		Feed consumed per kilogram of gain.	Live weight class.	Daily average per animal.		Feed consumed per kilogram of gain.
	Feed consumed.	Gain.			Feed consumed.	Gain.	
Kg.	Fodder units. <sup>1</sup>	Grams.	Fodder units. <sup>1</sup>	Kg.	Fodder units. <sup>1</sup>	Grams.	Fodder units. <sup>1</sup>
15-20.....	1.08		3.15	60-70.....	2.59	598	4.37
20-30.....	1.29	366	3.52	70-80.....	2.80	629	4.49
30-40.....	1.67	448	3.86	80-90.....	3.05	651	4.73
40-50.....	1.95	492	4.00	90-100.....	3.17	640	4.95
50-60.....	2.28	550	4.24	100-115.....	3.44	699	4.92

<sup>1</sup> Equivalent of 1 kg. of barley.

**Feeding pigs on pasture,** J. B. RICE (*Illinois Sta. Bul.* 247 (1924), pp. 37-60).—The results of pig feeding experiments carried on from 1911 to 1919 to compare the efficiency of different forage crops and different supplements to each are reported. The table below gives a summary of these results, showing the forage crops used and the supplements to each. The amount of corn fed daily is given as the percentage of the live weight of the pigs, whereas the tankage is given as the amount fed daily per pig. The amounts of pasture allowed each lot were one-half acre, except in case of lots 15 and 16, which were allowed one and one-quarter acres each; lots 38-43, inclusive, which were allowed one acre each; and lots 44 and 45, the amount of which is given in the table. Lots 1-21, 36, and 37 were finished in dry lot at the conclusion of the pasturing period to an approximate weight of 225 lbs., the feeds used being the supplements to the forage crops. Lots 7, 11, and 17 which received pasture only did so poorly that it was necessary to discontinue them early in order not to lose all the pigs. Lots 44 and 45 were to investigate the advisability of carrying heavy fat fall pigs (lot 44) and light thin fall pigs (lot 45) over the summer.

## Summary of hog feeding experiments on forage crops.

Lot.	Pasture crop.	Supplementary feeds.	Number of pigs per lot.	Beginning of test.	End of pasture period.	End of feeding period.	Average initial weight.	Average weight at end of pasturing period.	Average daily gain throughout entire test.	Concentrates per 100 lbs. gain.	
										Corn.	Tankage.
1	Rape	3 per cent corn	8	June 15	Oct. 5	Jan. 11	Lbs. 39	Lbs. 123	Lbs. 0.92	Lbs. 393	Lbs. 32
2	do	3 per cent corn and $\frac{1}{4}$ lb. of tankage.	8	do	do	Dec. 28	38	122	.94	368	37
3	Sweet clover	3 per cent corn	8	do	do	do	38	106	.79	404	38
4	do	3 per cent corn and $\frac{1}{4}$ lb. of tankage.	8	do	do	Jan. 4	38	117	.94	382	38
5	Blue grass	3 per cent corn	8	do	do	Jan. 11	38	109	.92	398	34
6	do	3 per cent corn and $\frac{1}{4}$ lb. of tankage.	8	do	do	Dec. 21	38	117	.98	364	39
7	Rape	None	8	June 11		Aug. 20	48		.03		
8	do	1.5 per cent corn	8	do	Oct. 15	Jan. 28	44	93	.84	455	22
9	do	3 per cent corn	8	do	do	Dec. 10	45	141	.99	411	12
10	do	Corn and tankage, self-fed.	8	do	do	Nov. 5	45	200	1.21	362	31
11	Alfalfa	None	8	do		Aug. 20	46		.06		
12	do	1.5 per cent corn	8	do	Oct. 15	Jan. 7	44	88	.85	493	27
13	do	3 per cent corn	8	do	do	Dec. 24	45	141	1.00	405	14
14	do	Corn and tankage, self-fed.	8	do	do	Nov. 5	45	203	1.20	373	36
15	Rotated <sup>1</sup>	1.5 per cent corn	16	June 25	do	Jan. 28	43	98	.79	437	22
16	Rotated <sup>1</sup>	3 per cent corn	16	do	do	Dec. 31	45	135	.91	418	13
17	Rape	None	8	June 15		Aug. 24	40		.02		
18	do	1.5 per cent corn	8	do	Oct. 5	Jan. 15	39	83	.83	384	26
19	do	Corn, self-fed	8	do	do	Dec. 11	38	123	1.00	368	27
20	do	Corn and tankage, self-fed.	8	do	do	Nov. 30	39	154	1.13	340	35
21	do	Corn, tankage, and middlings.	8	do	do	Nov. 16	38	160	1.20	311	<sup>2</sup> 31
22	Alfalfa	Corn and tankage, self-fed.	6	June 5	Nov. 6		46	254	1.35	341	30
23	do	do	6	do	do		45	269	1.45	320	28
24	Rape	do	6	do	do		46	236	1.24	356	30
25	do	do	6	do	do		45	260	1.39	328	29
26	Dry lot	Corn, tankage, middlings, and bran, hand-fed.	6	do	do		46	235	1.23	242	<sup>3</sup> 41
27	Alfalfa	Corn and tankage, self-fed.	7	June 10	Nov. 11		48	247	1.29	344	23
28	do	do	7	do	do		49	248	1.24	349	26
29	Rape	do	7	do	do		48	215	1.09	359	29
30	do	do	7	do	do		50	229	1.13	344	24
31	Red clover	do	8	June 17	Oct. 7		49	185	1.21	340	25
32	Alfalfa	do	8	do	do		49	179	1.16	309	28
33	do	do	8	do	do		49	176	1.03	339	24
34	Rape	do	8	do	do		49	171	1.10	337	27
35	do	do	8	do	do		49	166	1.04	332	25
36	Sweet clover	do	8	June 11	Oct. 15	Oct. 29	44	214	1.20	373	43
37	Dry lot	do	8	do	do	do	45	207	1.29	357	48
38	Alfalfa	3 per cent corn	10	June 5	Nov. 6		45	170	.81	336	
39	Alfalfa and rape.	do	10	do	do		45	161	.75	362	
40	Alfalfa	3 per cent corn and $\frac{1}{4}$ lb. of tankage.	12	June 10	Nov. 11		34	159	.78	328	32
41	Alfalfa and rape.	do	12	do	do		34	159	.80	327	31
42	Rape	do	14	June 12	Nov. 13		32	145	.69	333	36
43	Rape and alfalfa.	do	14	do	do		32	151	.73	329	34
44	Rotation <sup>1</sup>	Corn full-fed and $\frac{1}{4}$ lb. of tankage.	20	do	Sept. 4		247	327	.94	514	53
45	Rape	Corn <sup>5</sup> and 0.4 lb. of tankage.	15	June 10	Oct. 14		178	262	.66	463	17

<sup>1</sup> Field peas and oats, rape, and soy beans.<sup>2</sup> Also 56 lbs. middlings.<sup>3</sup> Also 112 lbs. middlings and 25 lbs. bran.<sup>4</sup> One-half acre Canadian field peas and oats and one-half acre rye to July 31, followed by 1 acre blue grass.<sup>5</sup> One and one-third lbs. corn per pig to August 19, with gradual increase to full-fed for the rest of the test.



The average results of the test indicate a slightly higher value for alfalfa than for the other crops except red clover in one trial. No advantage was shown for the combinations of forages. The feeding of light and medium corn rations was uneconomical, but medium rations had an advantage in allowing the pigs to utilize a larger part of the new corn crop. Tankage feeding also promoted gains and reduced the amount of feed required.

**Soy beans for horses and mules**, C. W. CRAWFORD and J. L. EDMONDS (*Illinois Sta. Circ. 276 (1924), pp. 8, figs. 3*).—A comparison of the composition of soy beans, soy-bean hay, and a straw with the more common concentrates, hays, and straws used as horse feeds indicates that the soy-bean products are equal if not superior to most of the other feeds in protein, total digestible nutrients, and calcium and phosphorus content. The circular is concluded by summarizing the experiences of various Illinois farmers who have successfully fed soy beans to work horses and mules.

**Certain correlations in the weight and number of eggs and the weight of fowls**, H. ATWOOD (*West Virginia Sta. Bul. 182 (1923), pp. 16, figs. 3*).—The relationship between the weights and numbers of eggs laid and the weights of the fowls has been studied from data collected on the flocks previously described (*E. S. R., 50, p. 71*).

Flock A received a liberal supply of sour milk in addition to other feeds during growth, whereas flock B received similar rations but the supply of milk was very limited. Flocks C and D were the daughters of flocks A and B, and flocks E and F were the daughters of A, B, C, and D. The feeding of flocks C and E was similar to that of A, whereas D and F were fed similarly to B. The following table gives some of the relationships between the periods of first laying, number of eggs laid during different periods, and the weights of the eggs:

*Relationship between egg weights and other factors.*

Flock.	Mean age of laying first egg.	Mean weight.	
		First 10 eggs laid.	Eggs laid during the year.
	Days.	Grams.	Grams.
A	178.3±1.3	44.20±0.30	50.22±0.26
B	198.1±1.7	46.51±.43	50.45±.37
C	196.9±3.3	45.50±.45	51.29±.30
D	226.3±1.9	46.57±.45	50.13±.39
E	209.9±1.9	47.02±.29	
F	247.9±1.7	49.86±.28	
A (second year)			55.87±.37
B (second year)			55.94±.48

Flock.	Coefficient of correlation.					
	Weight of first 10 eggs laid and age of first laying.	Weight of eggs for year and age of first laying.	Weight of first 10 eggs laid and weight of eggs for the year.	Number and mean weight of eggs.	Number and weight of eggs laid per month.	Weight of fowls and mean monthly egg weight.
A	+0.49±0.10	+0.04±0.14	<sup>1</sup> +0.55±0.07	+0.41±0.11	-0.79±0.08	+0.65±0.12
B	+.58±.08	+.33±.12	<sup>2</sup> +.79±.04	+.26±.13	-.44±.16	+.72±.10
C	+.61±.09	+.04±.15		+.19±.14	-.14±.19	+.71±.10
D	+.07±.15	-.03±.15		+.22±.14	-.13±.17	+.87±.10
E	+.68±.05					
F	+.34±.08					
A (second year)				+.24±.13	-.59±.13	+.47±.15
B (second year)				+.03±.15	-.88±.05	-.37±.18

<sup>1</sup> For flocks A and C.

<sup>2</sup> For flocks B and D.

In addition to the conclusions which might be drawn from the table, the author showed that the eggs of pullets increased in weight up to the end of the year. The weight of the hens' eggs decreased till June with increases during the remaining months.

**Twenty years of practice and experimentation in the poultry yard** (*Min. Agr. Prov. Québec Bul. 4* (1923), 3. ed., rev. and enl., pp. IV+174, pls. 4, figs. 107).—This is a popular manual of poultry production.

## DAIRY FARMING—DAIRYING.

**Dairy farming**, R. H. LEITCH (*Edinburgh: W. Green & Son, Ltd., 1923, pp. XII+292, pls. 12, figs. 31*).—This book deals with the principles of dairy farming and dairying. Chapters on the selection, buildings, and crops of the dairy farm; the feeding of dairy cows; chemical and physical properties of milk and cream; and the manufacture of butter and cheese are included. The book is especially designed for the practical dairyman.

**Dairying in Porto Rico**, D. W. MAY (*Porto Rico Sta. Bul. 29* (1923), Spanish ed., pp. 16, pls. 4).—This is the Spanish edition of the bulletin previously noted (*E. S. R.*, 48, p. 479).

**Canadian dairying** (*Ottawa: Canada Dept. Agr., 1923, pp. 32, figs. 14*).—This is a discussion of the amount of dairying that is being done in Canada and its provinces, with a brief article on the Canadian cow.

**Report on dairying and the dairy industry**, M. MOORE ET AL. (*Dublin: Conn. Inquiry Resources and Indus. Ireland, 1922, pp. [3]+32*).—This is a report of the commission of inquiry on the conditions of the dairy industry in Ireland.

**The product of dairy breeds compared**, J. MACINTOSH (*Jersey Bul. and Dairy World, 42* (1923), No. 44, pp. 2301-2303).—The milk and fat yields of the different breeds in the milking trials at the British Dairy Farmers' Association Show and the Royal Agricultural Society's Show in England during the years 1909 to 1921 and 1909 to 1922, respectively, are compared.

**Kreimhild herd**.—A chapter in **Holstein history**, F. N. DECKER (*Syracuse, N. Y.: Author, 1923, pp. 75, pl. 1, figs. 265*).—This is a popular discussion of the influence of the Holstein herd and importations of G. S. Miller on the development of the breed. The work contains many illustrations and extracts of letters and papers by early breeders and others acquainted with the herd.

**Comparing the production records of cows.—Influence of quality (fat test) of milk on yield of milk**, W. L. GAINES and F. A. DAVIDSON (*Illinois Sta. Bul. 245, abs. (1924), pp. 8, figs. 2*).—This is an abstract of the bulletin previously noted (*E. S. R.*, 50, p. 75).

**Cost of raising dairy heifers**, F. H. REED (*Canada Expt. Farms, Lacombe (Alta.) Sta. Rpt. Supt. 1922, pp. 19-21*).—The feeds consumed and the calculated costs of raising one purebred and two grade Holstein heifers to six months of age are given, as well as the monthly weights of each.

**Calculation of the nutritive value and fodder units of rations**, H. MØLLGAARD (*Tidsskr. Landøkonomi, No. 11* (1923), pp. 505-546).—A new method for calculating rations for milk production is outlined. The net energy of the milk is determined and the feeds required for the animals are calculated on the basis of the production coefficients of each feed; the production coefficient being an expression of the relation between the energy value of the digestible protein and the total energy of the feed. Maintenance requirements are calculated in proportion to the cube root of the square of the body weights. The production coefficients of the more common feeds are tabulated, and



several examples of the methods of determining rations for individual cows are given.

**Urea as a protein substitute for lactating ruminants**, F. HONCAMP, S. KOUDELA, and E. MÜLLER (*Biochem. Ztschr.*, 143 (1923), No. 1-2, pp. 111-155).—The efficiency of urea as a source of protein for lactating animals was studied in three experiments in which six different cows were used at the Rostock Agricultural Experiment Station in Germany.

In the first experiment one cow averaging 450 kg. in weight and giving 4 kg. of milk per day was fed a daily ration of 3.5 kg. of meadow hay, 2 kg. of oat straw, 1.5 kg. of dried beet pulp, and 1.5 kg. of rye bran, with a suitable salt mixture for two periods of 8 days each, with an intervening transitional period of equal length. Ninety gm. of urea containing 41.85 gm. of nitrogen were also furnished daily during the first 8 days. The milk production of this cow was 0.3 kg. per day more during the second period than during the first, and the fat production was 2.8 gm. more in the second period than when urea was being fed. There were only slight variations in the digestibility of the rations with and without urea feeding, but the average daily nitrogen balance was -8.76 gm. in the first period and -5.51 gm. in the second period. An average of 90.89 gm. of nitrogen was given off per day in the urine when urea was fed as compared with 45.48 gm. in the second period.

The cows averaging about 380 and 435 kg. in weight were employed for the first part of the second test, which consisted of three 8-day experimental periods with transition periods of equal length between the experimental periods. The rations consisted of corn meal, potato flakes, dried beet pulp, molasses-beet pulp, oat straw, and a salt mixture, with the addition of 150 gm. of urea per day to the ration of each cow during the first and third periods. The average daily production of the two cows, respectively, was in milk during the first period 9.78 and 11.74 kg. and in fat 327 and 325 gm.; in milk during the second period, 6.67 and 8.07 kg., and in fat 223 and 209 gm.; and in milk during the third period, 7.38 and 10.32 kg. and in fat 253 and 308 gm.

During the urea feeding periods daily nitrogen balances of +7.3 and +13 gm. were maintained by one cow and -1.1 and +4.7 gm. by the other cow, but during the period when no urea was fed the nitrogen balances were -8.1 and +16.2 gm., respectively, though the amount of nitrogen in the milk, feces, and urine was much reduced, especially in the latter case. The digestibility of all the nutrients was greater in the periods when urea was fed.

To get further proof of the results obtained in this experiment, another cow was similarly fed during three periods, with the addition of 120 gm. of urea to the ration per day in the first and third periods. The average daily milk and fat production in the first period was 5.74 kg. and 169 gm., in the second period 4.77 kg. and 113 gm., and in the third period 5.28 kg. and 144 gm., respectively. Again there was a large increase in the nitrogen eliminated in the urine during the urea feeding periods, but the nitrogen balance was also better maintained. The digestibility of all the nutrients except crude protein was, however, greater in the second period than in the first and third.

The general plan of the third experiment was similar to that of the first and second except that the two cows received a protein-rich basal ration containing 1 and 1.13 kg. of dried yeast, respectively, per day in the first and third periods, and in the second period this feed was replaced by sufficient urea to supply an equal amount of nitrogen, enough potato starch being added to furnish the same amount of energy. The average daily milk production of one cow during the first, second, and third periods was, respectively, 6.25, 5.48, and 5.04 kg.

and for the second cow 7.17, 5.78, and 5.94 kg. The daily fat production of the first cow was 206, 202, and 184 gm. during the first, second, and third periods, and of the second cow 229, 186, and 200 gm., respectively.

The nitrogen balances were positive in all cases, though slightly less during the urea period for one cow. In the case of the other cow the balance was only 2.62 gm. per day during the urea feeding, as compared with 10.6 and 12.5 during the yeast feeding periods.

The authors conclude from the three experiments that in a ration containing a normal amount of protein from 30 to 40 per cent of it may be replaced by urea without any great injury to the milk production.

**Dietary factors influencing calcium assimilation.**—IV, The comparative efficiency of mixed green grasses and this same mixture plus steamed bone meal in maintaining calcium and phosphorus equilibrium in milking cows, E. B. HART, H. STEENBOCK, C. A. HOPPERT, and G. C. HUMPHREY (*Jour. Biol. Chem.*, 58 (1923), No. 1, pp. 43-57).—In continuing this series of studies (E. S. R., 48, p. 477), the results are reported of two experiments dealing with the calcium and phosphorus balances of 3 lactating cows in each experiment, receiving daily rations of 40 lbs. of fresh green grass in addition to 20 to 25 lbs. of corn silage and a grain mixture of yellow corn, wheat bran, and oil meal. During one of the two 3-week periods of each experiment 200 gm. of bone meal was also supplied to each cow. The following table summarizes the results, giving the average weekly milk production and the average daily calcium and phosphorus balances by weekly periods for the cows in both experiments:

*Average daily calcium and phosphorus balances of lactating cows receiving green grass with and without bone meal.*

Ex- peri- ment.	Week.	Period.	Cow No. 1.			Cow No. 2.			Cow No. 3.		
			Weekly milk produc- tion.	Average daily balance.		Weekly milk produc- tion.	Average daily balance.		Weekly milk produc- tion.	Average daily balance.	
				Cal- cium.	Phos- phorus.		Cal- cium.	Phos- phorus.		Cal- cium.	Phos- phorus.
			Lbs.	Gm.	Gm.	Lbs.	Gm.	Gm.	Lbs.	Gm.	Gm.
1	1	Green grass.....	364.7	-54.15	-23.08	386.2	-43.92	-0.04			
1	2	do.....	353.9	-8.96	+15.27	369.5	-21.16	+8.29			
1	3	do.....	352.9	-10.71	+17.82	365.1	-16.05	+2.04			
1	4	Green grass and bone meal.....							326.6	-7.51	+114.46
			338.4	+35.66	+39.79	352.0	+34.53	+21.83			
1	5	do.....	312.3	-7.74	-15.69	343.8	-21.73	-15.78	325.3	+61.72	+154.28
1	6	do.....	312.9	+9.08	+16.91	347.6	-14.95	-8.26	306.8	+1.07	-8.79
2	1	Green grass.....	334.6	-22.99	+1.47	152.2	-.38	+4.13	332.8	+15.05	+124.81
2	2	do.....	328.8	-4.41	-4.17	135.3	+5.11	+4.69	164.5	-2.26	-2.94
2	3	do.....	327.6	-10.51	+18.39	142.2	-12.77	+3.82	227.3	-.76	+2.18
2	4	Green grass and bone meal.....							219.1	-5.79	+5.63
			310.0	+18.20	+34.62	156.5	+9.92	+23.14			
2	5	do.....	292.6	-7.59	+19.79	130.1	+10.75	+10.22	205.0	+8.87	+26.91
2	6	do.....	246.7	+2.37	+1.84	123.2	+2.55	+5.51	207.9	+.63	+3.37
									149.8	+17.83	+3.67

The differences between the calcium balances of cows 2 and 3 in the first experiment suggest the effect of previous treatment, since No. 3 had been on a low calcium ration prior to the experiment and, therefore, was in a more depleted condition and better able to assimilate calcium, whereas Nos. 1 and 2 had received a high calcium ration and some pasture before the test started. In the second experiment the cows used were fed different rations by design for about 4 months prior to the test as follows: No. 1, a good grade of alfalfa



hay in addition to corn silage and grain; No. 2, timothy hay of poor quality, with corn silage and grain; and No. 3, corn stover and grain only.

The results of these tests made it evident that it was impossible to maintain calcium equilibrium with green grass without a supply of extra calcium salts even in cows which had previously been on calcium poor rations. The authors suggest that the conducting of these experiments in direct sunlight might have influenced the calcium assimilation. Phosphorus equilibrium was maintained at nearly all times during the experiments even without the mineral supplement, probably due to the large amounts of phosphorus supplied in the wheat bran. For practical feeding operations, it is suggested that at least 4 gm. each of  $\text{CaO}$  and  $\text{P}_2\text{O}_5$  per pound of milk produced be supplied to dairy cattle to maintain calcium and phosphorus equilibrium.

**Comparative value of corn and sorghum silage** (*South Carolina Sta. Rpt. 1923, pp. 14, 15*).—In experiments lasting over several years, sorghum silage has been found to be 94.5 and 95.1 per cent as efficient for milk and fat production, respectively, as corn silage, although both seemed to have maintained body weight equally well. The yields per acre of sorghum silage are, however, much greater than corn silage.

**Active chlorin as a germicide for milk and milk products**, H. HALE and W. L. BLEECKER (*Jour. Agr. Research [U. S.], 26 (1923), No. 8, pp. 375-382, pls. 3, fig. 1*).—The germicidal action of active chlorin added in amounts of 1 part of chlorin to from 500 to 250,000 parts of milk has been studied in several experiments at the Arkansas Experiment Station. Sources of chlorin used were chlorin water, sodium hypochlorite, and calcium hypochlorite.

In the study it was found that the chlorin reduced the total bacterial counts of the milk and in specific tests the numbers of *Sarcina lutea* colonies in milk inoculated with this organism, but it had an irregular effect on the colonies of *Staphylococcus pyogenes aureus* with which other samples had been inoculated. Chlorin from chlorin water was the most effective and quickest acting, giving as good results in 45 minutes as sodium hypochlorite did in 90 minutes and calcium hypochlorite in 19 hours. The flavor of the chlorin from chlorin water was also less noticeable than from the other solutions, dilutions of 1: 4,000 not being noticeable in the flavor.

**The book of butter**, E. S. GUTHRIE (*New York: Macmillan Co., 1923, rev. ed., pp. XIII+307, figs. 60*).—This is another edition of the book previously noted (E. S. R., 40, p. 283), which includes in addition to the former volume a description of the Storch test and an appendix containing a discussion of cream neutralization, as well as dairy and butter statistics.

**Pasteurization of milk for Cheddar cheese making: The bacteriological aspect**, J. K. MURRAY (*Agr. Gaz. N. S. Wales, 34 (1923), No. 8, pp. 559-566, figs. 4*).—In experiments at the Hawkesbury Agricultural College and the Moruya Cooperative Cheese Factory it has been found that flash pasteurization at 155, 165, and 175° F. or holding pasteurization at 145° for 30 minutes tends to control the fermentation of the milk to be used in cheese making and also reduce the undesirable organisms present. The quality of the cheese made from such milk is thereby improved.

**How acidity affects the quality of the mix**, B. I. MASUROVSKY (*Ice Cream Trade Jour., 19 (1923), No. 10, pp. 78, 79*).—The increases in acidity of portions of an ice cream mix previously pasteurized and inoculated with commercial starter and ripened for 24 hours at different temperatures were recorded. The acidity of the mixes at the start was 0.17 per cent of lactic acid, but by holding at room temperature (60 to 75° F.) it increased to 0.77 and at 50° to 0.25 per cent, but when held at 40 to 45° there was a decrease of 0.005 per cent

An uninoculated sample held at the latter temperature also decreased 0.005 per cent.

The four mixes were combined in proper amounts to have an acidity of 0.295 per cent of lactic acid, but when frozen a disagreeable lactic acid flavor persisted even when caramel was used as a flavoring.

**Commercial casein**, compiled by W. W. FISK (*Milwaukee, Wis.: Olsen Pub. Co., 1923, pp. 44+XVI*).—The method of preparing commercial casein is given, as well as other miscellaneous information.

## VETERINARY MEDICINE.

**A technical treatise on hematology: Morphology, histogenesis, histophysiology, histopathology**, J. JOLLY (*Traité Technique d'Hématologie: Morphologie, Histogenese, Histophysiologie, Histopathologie. Paris: A. Maloine & Son, 1923, vols. 1, pp. X+560, figs. 363; 2, pp. 561-1131, pl. 1, figs. 336*).—A comprehensive text on hematology.

**A method for the determination of the specific gravity of red blood cells**, P. REZNIKOFF (*Jour. Expt. Med., 38 (1923), No. 4, pp. 441-444*).—The author describes a simple method for determining the specific gravity of red blood cells that is more rapid than and as accurate as pycnometer determinations. The marked chemical and physical interactions between corpuscles and suspension fluids in other methods are avoided.

**The physiological effect of gossypol**, P. MENAUL (*Jour. Agr. Research [U. S.], 26 (1923), No. 5, pp. 233-237*).—This is a contribution from the department of chemistry of the Oklahoma Experiment Station. The author finds from experiments conducted on rabbits that gossypol is absorbed slowly when administered through the diet, and its toxic action is slow to make its appearance.

“When introduced directly into the blood stream its toxic action is manifest at once. Its most serious effect is on the blood. By determining the amount of oxygen that can be liberated from blood before and after the addition of small quantities of gossypol, it is clear that in some manner the gossypol prevents the liberation of free oxygen from oxyhemoglobin. Gossypol also exerts a hemolytic effect on the erythrocytes. Gossypol caused death in animals by reducing the oxygen-carrying capacity of the blood. Thus an excessive burden is thrown on the respiratory and circulatory organs which results in the condition found in animals that have died from gossypol or cottonseed meal poisoning, namely, a passive hyperemia and edema of the lungs and some hydrothorax. These conditions are always present and are not due to bacterial infection.”

A list is given of 10 references to the literature cited.

**The microscopic determination of the number of bacteria in bacterial vaccines**, H. SOMMER (*Centbl. Bakt. [etc.], 1. Abt., Orig., 90 (1923), No. 6, pp. 468-478*).—A modification of the Fries method of determining bacterial count (*E. S. R., 46, p. 412*) is described, the essential feature of which is the addition of the fuchsin solution to the suspension of bacteria and yeast before the slides are made. This does away with the usual process of fixing and washing the slides and is thought to give more accurate results. The strength of the fuchsin solution to be used is best determined for each suspension to be tested.

**The development of protection after prophylactic inoculation**, W. F. HARVEY and K. R. K. IYENGAR (*Indian Jour. Med. Research, 10 (1923), No. 4, pp. 990-995*).—In continuation of their work on various immunity problems (*E. S. R., 50, p. 282*), the authors have attempted to determine the rate of



development of protection against a given microorganism following prophylactic inoculation. Pigeons were immunized against *Bacillus avisepticus* with the double prophylactic dose previously described (E. S. R., 48, p. 278) and were tested at varying intervals of time thereafter by the intravenous injection of varying doses of the living organism. Agglutination tests were made simultaneously with the protective tests. Two pigeons were used for each test.

The pigeons which were tested seven days after the first protective dose and before the second showed no evidence of protection, but from the second day after the second dose the extent of protection increased up to about the fourteenth day and was maintained up to the thirtieth day. The agglutination results did not correspond with the protection results. The agglutinins did not appear in the serum until the fourth day after the second dose, began to disappear about the eighth or tenth day, and had disappeared to a marked extent on the eighteenth or twenty-second day.

**The duration of protection after prophylactic inoculation,** W. F. HARVEY and K. R. K. IYENGAR (*Indian Jour. Med. Research*, 10 (1923), No. 4, pp. 1147-1149).—The above study has been extended to the time at which the immunity entirely disappeared, agglutination tests again being conducted simultaneously with the protection tests.

A high degree of protection was manifest for three months, but tests at the end of the fifth month showed an almost complete loss of protection. With the loss of protection there was an entire disappearance of agglutinins, but the agglutinin titer was not very high even at the height of protection.

**Some pathological phases of bovine reproduction,** A. SAVAGE (*Agr. Gaz. Canada*, 10 (1923), No. 6, pp. 523-534).—This is a review of the subject, presented in connection with a list of 44 references to the literature. "If one may draw any conclusion from all the work published on this and kindred subjects to date, it is that common sense, competent supervision, and close cooperation between the breeder and his veterinary adviser seem to afford the only avenue of escape from one of the greatest menaces to the whole cattle business."

**The behavior of germ-free culture filtrates of abortion bacilli in vitro and in vivo,** G. RAUCHBAAR (*Über das Verhalten Keimfreier Abortuskulturfiltrate in Vitro und in Vivo. Inaug. Diss., Vet. Inst., Univ. Leipzig, 1923, pp. 12*).—On cultivating a virulent strain of *Bacillus abortus* successively on mouse litmus milk for from 24 to 48 hours, defibrinated beef blood for 48 hours, and 2 per cent peptone agar with 10 per cent defibrinated beef blood for 24 hours, followed by successive passages through mice, the virulence was increased to the extent that, while after the third passage 5,000 millions were necessary to kill a mouse on intraperitoneal injection, after the ninth mouse passage 500 millions sufficed.

The organism was killed in 24 hours in heat-sterilized urine, but in non-sterilized urine remained alive for at least 9 days. The organism as recovered from the ninth animal passage, when grown in peptone bouillon, proved to be a strong alkali builder. In one case the pH value of the bouillon increased from 6.8 to 7.2 in 4 days and to 8.2 in 12 days.

Bouillon culture filtrates gave unreliable results as antigens in complement fixation tests. This is attributed to the peptone and extractives present. For the formation of agglutinins and complement binding amboceptors in rabbits, 2 cc. of the culture filtrate proved about equal to 30,000 millions of killed bacilli.

The culture filtrate had a tryptic action due to the present of a thermolabile enzym destroyed at 60° C. Some culture filtrates proved suitable for the active immunization of mice and others not. The difference in behavior is attributed to the varying content of toxin.



**Detection of discharge of *Bacillus abortus* in the milk of infected cows,** W. PFENNINGER (*Schweiz. Arch. Tierheilk.*, 65 (1923), No. 12, pp. 600-609).—Following a review of the literature, the author reports upon an investigation in which 8 of 23 infected cows were shown, through guinea pig inoculation, to discharge abortion bacilla in their milk.

**Potency tests for blackleg filtrate and aggressin based on the aggressive action of these products,** J. P. SCOTT (*Jour. Amer. Vet. Med. Assoc.*, 64 (1923), No. 1, pp. 67-74).—A description with illustrative data is given of two tests which have been developed at the Kansas Experiment Station for the grading of blackleg immunization products.

The first or neutralization test has been described previously (*E. S. R.*, 40, p. 381). The second or washed culture test depends upon the fact that virulent cultures of *Clostridium chauvoei* are rendered avirulent by repeated washing in salt solution and are reactivated by the addition of the filtrate. The test consists in measuring the smallest dose of filtrate that will activate a unit of washed culture corresponding to 1 m. l. d. This unit, which is called the potential m. l. d., is calculated by comparing the m. l. d. of the virus before washing with the smallest dose of washed culture that is activated by small doses of filtrate. The washed culture test and neutralization test are said to give comparable results.

**Prevalence of toxin-producing anaerobes in Wisconsin,** F. M. BACHMANN and E. HAYNES (*Jour. Infect. Diseases*, 34 (1924), No. 2, pp. 132-136).—"One hundred and forty-six samples of Wisconsin soils, leaves, insects, and other material related to soil were cultivated in sterile meat medium to determine whether *Clostridium botulinum* or other toxin-producing anaerobes were present. From home canned mushrooms an organism was isolated which produced symptoms similar to limberneck in chickens, and which was weakly toxic for guinea pigs. None of the other samples contained organisms which produced substances sufficiently toxic to kill guinea pigs when these were forcibly fed. Incubation of a few of the samples in the meat medium resulted in the production of substances which were weakly toxic."

**Pure cultures of *Clostridium botulinum* from single cells,** W. A. STARIN (*Jour. Infect. Diseases*, 34 (1924), No. 2, pp. 148-158).—The Barber capillary pipette method of isolating single cells (*E. S. R.*, 44, p. 477), with slight modifications in technique, was tested with cultures of *C. botulinum* types A and B. Out of 800 such isolations successful growth was secured in 253 cases. The method proved more satisfactory than the one involving the cultivation of single cells in symbiosis with nonsporulating aerobes or the one in which the hanging drop slide is used. The most suitable media were semisolid glucose agar, glucose broth, and pea juice gelatin. A higher percentage of growth was obtained with the use of spores than with vegetable cells.

The rate of growth and toxin production was more rapid at 37° C. than at 20°, but the quantity of toxin produced eventually was the same at both temperatures. Type A uniformly produced toxin more rapidly than type B. From four separate strains, the original cultures of which produced type A toxin, both A and B types were isolated, A being predominant. It is thought probable that both strains grow together in nature. No nontoxic strains were produced.

Thirty attempts to isolate cultures of type C by this method proved unsuccessful.

**Botulism: Studies on the manner in which the toxin of *Clostridium botulinum* acts upon the body,** E. C. DICKSON and R. SHEVYK (*Jour. Expt. Med.*, 37 (1923), No. 5, pp. 711-731, figs. 5; 38 (1923), No. 4, pp. 327-346, pl. 1, figs. 4).—Two papers are here presented:



I. *The effect upon the autonomic nervous system* (pp. 711-731).—The experiments reported are thought to show conclusively that in botulinus intoxication in cats, dogs, and rabbits there is a specific effect upon the portions of the autonomic nervous system which W. H. Gaskell<sup>1</sup> has described as the bulbosacral and prosomatic outflows of connector fibers, respectively, which results in a blocking of the nerve impulses of these nerves. It is concluded that the experimental as well as the clinical evidence indicates that there is no damage to the nerves of the thoracolumbar outflow.

"The exact location of the damage has not been ascertained, nor has the mechanism by which the nerve impulse is blocked been determined. The experiments show, however, that the lesions in these portions of the nervous system are not of central distribution but are peripheral, and that the block can not be due to an organic break in the conduction apparatus but must be due to some derangement which is relatively unstable. If it were otherwise it would not be possible to induce a physiological response even by massive stimulation, nor could the response be subsequently repeated by stimuli which lie within the limits of normal intensity." A bibliography of 18 titles is included.

II. *The effect upon the voluntary nervous system* (pp. 327-346).—The investigations reported have led the authors to draw the conclusion that "the toxin of *C. botulinum*, types A and B, exerts an influence upon the endings of the motor fibers of the voluntary nervous system which leads to a marked susceptibility to fatigue. It has not been determined whether the damage is in the anatomical nerve endings of the somatic motor nerve fibers or upon the myoneural junction, but it is not of the nature of an organic destruction of tissue. There is no effect upon the sensory fibers of the peripheral nerves. The muscle cells of the smooth and striated muscles are not affected. The disturbances in function which have been demonstrated in the voluntary and involuntary nervous systems fully explain the characteristic signs and symptoms of botulinus intoxication." A bibliography of 15 titles is included.

**Bradsot or braxy, J. P. McGOWAN** (*Centbl. Bakt. [etc.]*, 1. Abt., Orig., 91 (1923), No. 1, pp. 54-63).—It is pointed out by the author that the disease known as bradsot as it occurs in Iceland, Norway, and certain other countries, and braxy as it occurs in Scotland are identical. He reviews the literature, and reports experimental work which has led him to conclude that this disease is the hyperacute form of hemorrhagic septicemia and is caused by *Bacillus bipolaris septicus*. Its geographical distribution is dealt with, and the importance of secondary factors in bringing it about is emphasized.

**Foot-and-mouth disease: Research work problems** (*Vet. Rec.*, 3 (1923), No. 52, pp. 939-942).—A review of the problem, in which the slaughter policy of controlling foot-and-mouth disease in Great Britain is thought to be vindicated.

**Foot-and-mouth disease immunity following artificial and spontaneous infection as well as following simultaneous immunization, O. WALDMANN and K. TRAUTWEIN** (*Centbl. Bakt. [etc.]*, 1. Abt., Orig., 90 (1923), No. 6, pp. 448-457).—Previous investigations concerning the production of immunity against foot-and-mouth disease in guinea pigs (*E. S. R.*, 46, p. 277) have been extended to swine and cattle, with the following results:

Following the intravenous injection of from 0.2 to 0.5 cc. of virulent lymph, swine were found to develop fever in about 24 hours, and in another 24 hours to show typical eruptions in the feet and on the tongue. Later intracutaneous injection of the same lymph did not cause general eruption, thus

<sup>1</sup> The Involuntary Nervous System. London and New York: Longmans, Green & Co., 1916, pp. IX + 178.



showing that tissue immunity had been produced by the first injection. Blood immunity could be detected in about 4 days in swine and cattle as compared with 7 or 8 days for guinea pigs.

Attempts at simultaneous immunization with serum and lymph were conducted on cattle. Of 28 animals receiving from 50 to 200 cc. of cattle-immune serum, together with 0.1 cc. of swine lymph injected intravenously, 8 had a temperature reaction on the second and third day but without eruption, and the remaining 20 showed slight eruptions. The same animals were injected intravenously with 1 cc. of lymph from 8 to 25 days later without effect. In no case could complement-deviating bodies be found.

**Immunity in foot-and-mouth disease**, H. VALLÉE and H. CARRÉ (*Compt. Rend. Soc. Biol. [Paris]*, 90 (1924), No. 3, pp. 177-179).—In this general discussion the conclusion is drawn that in searching for a means of immunizing against foot-and-mouth disease a method of immunizing the skin must be sought, since, in the opinion of the authors, it is only through such limited local immunity that general immunity can be produced.

**The effect of magnesium sulphate, simultaneously administered, on the efficacy and safety of carbon tetrachlorid for the removal of hookworms**, M. C. HALL and J. E. SHILLINGER (*Amer. Jour. Trop. Med.*, 4 (1924), No. 1, pp. 1-12).—The authors find the experiments with dogs, here reported, to indicate that the efficacy of carbon tetrachlorid is not impaired by the simultaneous administration of magnesium sulphate. "The work of [D. I.] Macht and [E. M.] Finesilver<sup>1</sup> indicates that this simultaneous administration will result in decreased absorption of carbon tetrachlorid and thereby increase the safety factor. This method of administration of carbon tetrachlorid deserves test as a possible method of increasing the safety of carbon tetrachlorid and avoiding the occasional bad results obtained with this highly effective anthelmintic."

**Report of a case of Malta fever originating in Baltimore, Md.**, C. S. KEEFER (*Bul. John Hopkins Hosp.*, 35 (1924), No. 395, pp. 6-14, fig. 1).—The author reports upon a case of Malta fever occurring sporadically in Baltimore, the organism isolated from which has been shown to belong to the abortus group of *Brucella melitensis*, indicating that the origin of the infection was bovine and not caprine. This is said to be the first reported case of a disease in man corresponding to Malta fever due to the *Bacillus abortus* group of *Brucella*. The paper includes a review of the literature on the occurrence of Malta fever in this country and of the studies which have demonstrated the close relationship between the organism causing Malta fever in man and infectious abortion in bovines. The recent terminology of the *B. melitensis* group of organisms is discussed. A bibliography of 55 titles is included.

**Necrobacillosis**, G. H. GLOVER (*Colorado Sta. Bul.* 289 (1923), pp. 3-12, figs. 3).—This is a brief summary of information on the status of knowledge of this affection in its several forms, including necrotic stomatitis, calf diphtheria, lip-and-leg ulceration of sheep, necrotic dermatitis, necrotic enteritis, contagious foot rot, nodular necrosis of the liver, and other forms of necrobacillosis.

**Iron content of the blood and spleen in infectious equine anemia**, L. H. WRIGHT (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 5, pp. 239-242).—The author here reports on a study undertaken while working on the problem of infectious anemia. The results are presented in tabular form, one table reporting upon the iron content of horses' spleen and another on the iron content of horses' blood in infectious equine anemia.

---

<sup>1</sup> Bul. Johns Hopkins Hosp., 33 (1922), No. 379, pp. 330-338.



It was found that the average totals of the solids (iron, hemoglobin, and erythrocytes) are greater in the normal animals than in the sick ones. "There is more actual anemia due to a lack of iron, and therefore a deficiency of hemoglobin, than the total erythrocytes would indicate. This also would be expected from the large number of shadow corpuscles which are often found in cases of anemia. The increased iron content of the spleens of the young animals can not be due solely to the increased quantity of blood in the organ, for if the extra weight of the spleen were due wholly to the weight of blood the additional iron would not be sufficient to account for the increase."

**Specific infectious pneumonia of foals: A new pyogen in the horse,** H. MAGNUSSON (*Arch. Wiss. u. Prakt. Tierheilk.*, 50 (1923), No. 1, pp. 22-38, figs. 5; *abs. in Jour. Amer. Vet. Med. Assoc.*, 64 (1924), No. 4, pp. 489).—The author describes a new disease of colts, which occurs in Sweden and may have been previously observed in Hungary and Denmark. Descriptions are given of 12 field and several experimental cases, which indicate that a new organism, for which the name *Corynebacterium equi* is proposed, is the causative agent. The disease is characterized by subacute or chronic broncho-pneumonia, with circumscribed abscess formations in the parenchyma of the lungs.

**Relation of *Bacterium pullorum* to hatchability of eggs,** F. R. BEAUDETTE, L. D. BUSHNELL, and L. F. PAYNE (*Jour. Infect. Diseases*, 33 (1923), No. 4, pp. 331-337).—This is a report of investigations conducted at the Kansas Experiment Station.

Application of the agglutination test to a flock in which poor hatching was reported showed 15.8 per cent of the fowls to be infected with *B. pullorum*. "The fertile eggs from infected hens gave a 53.58 per cent hatch, whereas the fertile eggs from noninfected hens gave a 65.1 per cent hatch. Fertile eggs from all infected hens do not give a uniformly low hatch. This suggests the possibility that other factors are necessary to bring about death of the embryo during the incubation period. Infection by *B. pullorum* has been found to cause a marked reduction in fertility. For one flock the fertility of eggs from infected hens was 57 per cent as compared with 90.4 per cent fertility for non-infected hens."

**Neuritis-epizooty in poultry at Barneveld in 1921,** N. VAN DER WALLE and E. WILNLER-JUNIUS (*Tijdschr. Vergelijk. Geneesk.*, 10 (1924), No. 1, pp. 34-50, pls. 7).—This is the report of a study made of the outbreak of neuritis among fowls which took place at Barneveld, Netherlands, in 1921. Experiments conducted seem to prove that the disease is due to a filterable virus.

**The latest method in the control of chicken pox and roup by vaccination,** J. W. FULLER (*Cornell Vet.*, 14 (1924), No. 1, pp. 51-54).—Previously noted from another source (*E. S. R.*, 50, p. 586).

## RURAL ENGINEERING.

**The occurrence of ground water in the United States,** O. E. MEINZER (*U. S. Geol. Survey, Water-Supply Paper* 489 (1923), pp. XI+321, pls. 31, figs. 110).—This is the first of a series of six papers on ground water in the United States. It deals with the principles of occurrence of ground water, kinds of rocks and their waterbearing qualities, structure of rocks and its influence on ground water, and waterbearing formations in the United States. In order to effectively summarize the occurrence of ground water, the United States is divided into 21 ground water provinces.

**Report on investigations into the improvement of river discharge measurements, I-III,** E. B. H. WADE (*Egypt Min. Pub. Works, Phys. Dept.*

*Papers 4 (1921), pp. VII+21, pls. 18; 6 (1922), pp. 12, pls. 14; 7, pp. 6, pls. 10).*—This report is in three parts:

Part 1 reports the development of a special ratchet gauge designed to overcome the influence of turbulence in streams. The gauge developed can not give any reaction in water which is flowing in the ideally simple manner, but it can and does give a reaction when immersed in water in which differential movement exists. Experiments with this instrument at a number of stations which were known to be turbulent, and at which the discharges indicated by Gurley current meters were too high by determined amounts, showed that, as an average, an indication of about 3 units on the gauge scale corresponded to an excess of about 15 per cent in the current meter discharge.

In part 2 it is shown that when the velocity of a stream is very low its measurement presents special difficulties, and that there is a demand for an improved type of current meter to deal with the case of sluggish flow. The development of a current meter for this purpose is described, in which a helix is driven by an independent constant power and the effect of the stream is merely to increase or diminish the rate of the helix by an amount which serves as the measure of the velocity of the stream. Graphic data are presented from actual tests, indicating the advantage from using an independent constant power in this manner.

Part 3 deals with actual tests of the instrument described in part 2 in making measurements of the discharge of the Blue Nile during the low stage. The low velocity current meter was compared with the Gurley instrument, using various driving weights and propeller angles. With a weight of 20.5 gm. and a pitch angle of 25°, a favorable rating curve was obtained which was, however, by no means free from flattening in the neighborhood of the slack water reading. With other values of the driving weight and pitch angle the flattening was more serious, and in the case where the pitch angle was 40° and the weight 56 gm. the amount of flattening and consequent loss of sensitiveness at low velocity was considered prejudicial to accuracy. Suggestions for preventing the flattening of the rating curve are made.

**Irrigation in India**, D. G. HARRIS (*London and Bombay: Humphrey Milford, Oxford Univ. Press, 1923, pp. [5]+102*).—This is volume 3 of a series of booklets on India of To-day, published under the general editorship of L. F. R. Williams, and deals with the practical aspects of irrigation in India. It is divided into two parts. Part 1 contains general information on the subject, and part 2 is a brief history of State irrigation in India.

**The clay deposits of Kentucky**, H. RIES (*Ky. Geol. Survey, 6. ser., 8 (1922), pp. [8]+421, pls. 3, figs. 60*).—This is an economic consideration of the pottery, brick, and tile clays, fire clays, and shales of Kentucky. Notes on their industrial development are included.

**The building stones of Kentucky**, C. H. RICHARDSON (*Ky. Geol. Survey, 6. ser., 11 (1923), pp. [10]+355, figs. 86*).—This is a detailed report covering the examination, analysis, and industrial evaluation of the principal building stone deposits of the State.

**Some factors which affect the plasticity of a paint**, E. C. BINGHAM and A. G. JACQUES (*Indus. and Engin. Chem., 15 (1923), No. 10, pp. 1033-1036*).—The results of a study conducted at Lafayette College of the factors which influence the plasticity of paints are presented.

These showed that as the grinding of a pigment in oil progresses the yield value at first decreases, but after 30 hours becomes constant. The mobility under the same conditions at first increases, passes through a maximum, and then decreases more and more rapidly. The maximum was found to occur after about 30 hours.



On measuring different concentrations of pigment suspended in oil, the yield value-weight concentration curve was found to be linear except at low concentrations. All concentrations exhibited a yield value, that having zero yield value being apparently independent of the nature of the medium. The mobility-weight concentration curve was also linear, and the concentration of zero mobility was apparently independent of the nature of the vehicle. Silica and lithopone had very different plasticities at the same weight concentration. When compared at equivalent volume percentages, however, the mobilities were nearly the same, and the yield values were not very different.

A comparison of blown oil and acid-refined linseed oil at the same concentration of pigment showed that the mobility fell off in presumably the same ratio as the fluidity of the oil, but the yield value was independent thereof. Polar colloids, such as aluminum stearate, had a very slight influence on the mobility but exerted an extraordinary effect in raising the yield value. It was difficult to grind a pigment into pure mineral oil having the same fluidity as linseed oil, and still more difficult to make a satisfactory plasticity determination on the resulting suspension. However, 0.2 per cent of oleic acid deflocculated a suspension and lowered the yield value about 80 per cent, while the mobility remained unchanged.

Moisture exerted a prodigious effect on the plasticity of paint, 0.5 per cent of moisture raising the yield value from 90 to 3,450, and at the same time reducing the mobility to one-fourth of its former value.

Oxidation and polymerization were found to affect the fluidity of an oil. It is thought that the fall in the mobility on long grinding may be attributed to one of these causes. A paint ground in an atmosphere of carbon dioxide had a yield value three times as high as when ground in air.

**An economical farm level**, L. J. SMITH (*Washington Col. Sta. Pop. Bul. 124* (1923), pp. 11, figs. 6).—A homemade level is briefly described and its use illustrated.

**A treatise on gear wheels**, G. B. GRANT (*Philadelphia: Philadelphia Gear Works, 1923, 16. ed., pp. [1]+105, figs. 169*).—The theory of different kinds and types of gear wheels is presented in this treatise.

**Inspection tests of small seeding machines, tillage machinery for the cultivation of orchards, and potato sorting machines**, G. FISCHER ET AL. (*Arb. Deut. Landw. Gesell., No. 320* (1922), pp. 88, figs. 50).—Tests of a large number of different small seeding and tillage machines and potato sorting apparatus and service tests of miscellaneous machines are presented.

**Testing the efficiency of silage cutters**, F. W. DUFFEE (*Agr. Engin., 5* (1924), No. 1, pp. 3-6, figs. 3).—Tests at the University of Wisconsin on the draft of silage cutters and the influence of using antifriction bearings thereon and on the distribution of power consumption are reported. Twenty different machines were used in the cutting and blowing of silage into 7 silos. Half-day tests were made in practically all cases on each machine.

The results showed a wide variation in the power requirements of the different machines and indicated that a light draft machine is more a matter of perfection of design than of type. The variation in draft due to difference in design was so great as to preclude the drawing of definite conclusions regarding the saving of power by using antifriction bearings. The power required increased gradually and slowly as the height of elevation increased. Wide discrepancies were brought to light in the study of the power required for the separate operations of cutting and blowing.

A marked relation between revolutions per minute and power requirement was developed. In several tests the capacity in tons per hour actually decreased



as the machine was speeded up. The power required decreased regularly as the speed was reduced, but at the higher speeds there was an extremely wide fluctuation in power requirements.

**The lower limits of concentration for explosion of dusts in air,** L. J. TROSTEL and H. W. FREVERT (*Chem. and Metall. Engin.*, 30 (1924), No. 4, pp. 141-146, figs. 5).—The results of recent studies by the U. S. D. A. Bureau of Chemistry on the lower limits of concentration for explosion of powdered corn starch, corn elevator dust, standard Pittsburgh coal, powdered sugar, powdered aluminum, wheat elevator dust, and powdered sulphur with three different kinds of ignition are presented and interpreted in the light of industrial requirements. The three types of ignition used were the glower, arc, and induction spark.

A comparison of the limits for three types of ignition showed that the heat capacity of the ignition source has a decided effect on the lower limit of concentration for explosion of dusts in air. The thermal properties inherent in the dusts were found to affect also the lower limit. Added to these effects is that of the specific heats of the various substances. The organic dusts, for instance, have the greater specific heat. The various specific heats have their effect on the flammability of thin suspensions, since the dust cloud particles absorb heat and their heat capacity depends on the specific heat and on the ignition temperature. If the initial quantity of heat to be absorbed is comparatively large, combustion may not take place, depending somewhat on how much heat has been generated. In the case of wheat elevator dust for temperatures below 150° C. (302° F.), it was found that 67 per cent of the heat absorbed by the dust during the temperature rise to 150° was taken up by the water and ash. This is taken to indicate that in accounting for differences in the explosibility of various dusts the dampening effect of moisture and ash apparently must be considered.

The chemical composition of the cereal dusts is considered of interest in explaining the variation in lower explosive limits of the substances studied. The fact that corn and wheat elevator dusts must be present in heavier concentrations than starch in order to explode is considered to be due probably, in great measure, to the large quantity of ash present in the elevator dusts as compared with that in starch. The difference in behavior of the two elevator dusts alone when exposed to an induction spark indicated that the crude fiber, making up 22.14 per cent of the wheat elevator dust and only 3.58 per cent of the corn elevator dust, is not as flammable as starch.

The data give no definite general relationship between ignition temperature, lower explosive limit, relative flammability, and heat of combustion. Regardless of the type of ignition used or weight of dust suspended, coal and sulphur generally produced the smallest pressure upon explosion, and aluminum, or possibly starch, the greatest pressures, with sugar and the elevator dusts occupying an intermediate position. The reason for this is explained. The two dusts, coal and sulphur, which are alike in being the least violently explosive, varied widely in lower limits. There seemed to be no special relation between relative flammabilities, which are determined mainly by the volume of gaseous products of combustion and the heat of combustion, and the lower limits of concentration for explosion of dust in air.

**Stresses in framed structures,** G. A. HOOL and W. S. KINNE (*New York and London: McGraw-Hill Book Co., Inc.*, 1923, pp. XIV+620, figs. 384).—This volume is intended to cover the design and construction of the principal kinds and types of framed structures. It contains sections on general theory; roof trusses; bridge trusses; lateral trusses and portal bracing; deflection of trusses;



redundant members secondary stresses; statically indeterminate frames; wind stresses in high buildings; and rectangular tower structures.

**Recent tests of ventilation systems in farm buildings**, M. A. R. KELLEY (*Agr. Engin.*, 5 (1924), No. 1, pp. 7, 8).—In a contribution from the U. S. Department of Agriculture, data from a number of tests of ventilation systems in farm buildings are briefly summarized.

The results of tests made in cooperation with Cornell University and the Maine Experiment Station showed that there is a close relation between flue velocity and a wind velocity of over three miles per hour, and very little relation when the wind velocity is less than three miles per hour. The outside temperature was also found to have a stronger influence on flue velocity than stable temperature.

Studies on the ventilation of three different types of poultry houses, in cooperation with the University of Nebraska, to determine the efficiency of tight construction in preventing fluctuations in temperature showed that the highest temperature in the houses during the month of February usually occurred about 4 p. m. It then proceeded to fall rapidly until early morning at which time it again rose, completing the cycle in the late afternoon. The temperature went down very rapidly when the birds went to roost in the evening and began to rise again shortly before the birds left the roost in the morning.

Tests of samples of air taken in the poultry houses before they were opened in the morning showed no significant difference in either the temperature or relative humidity of a house having a single thickness of drop siding, three double sash, and a muslin curtain 1 ft. wide above each window, and a similar house equipped with a 20-in. ventilator but with the muslin curtain sealed. However, there was less carbon dioxid in the latter. The former house contained even more carbon dioxid when the muslin was covered with heavy building paper. In this house the windows were always open at the top, and, consequently, the muslin is not given the entire credit for keeping the air as good as it was. In fact, the muslin seemed to exert but little influence.

The results of these studies are taken to indicate the importance of so directing further studies as to secure fundamental facts upon which broader and more definite explanations of causes and effects and their relationship may be based. Emphasis is placed upon the necessity of first ascertaining what constitutes good ventilation, and on the importance of securing the cooperation of veterinarians, animal husbandmen, and nutrition experts to aid in solving this first problem.

## RURAL ECONOMICS AND SOCIOLOGY.

**On the use of partial correlation in the analysis of farm management data**, M. EZEKIEL (*Jour. Farm Econ.*, 5 (1923), No. 4, pp. 198-213, figs. 3).—This paper is a discussion of analytical methods. It first points out in detail the results of a partial correlation analysis of the interrelationship between 16 different factors in the farm business, using farm survey data covering farms in Blackhawk, Tama, and Grundy Counties, Iowa (E. S. R., 47, p. 93). There is then taken up the net relation of each of the different factors to the labor income.

The most important factors in order of importance are the livestock index, the number of acres in crops, the crop index, and the efficiency of use of man labor. It is noted that the net effect of an increase of one point in either index has an almost identical effect upon the labor income. Crop acres, more than any other single factor, appear to be the best criterion of the effect of size of business upon the labor income. A study of the net relation between



capital and labor income seems to indicate that where the assumed interest rate exceeds the actual average net earnings of capital there is introduced an artificial bias against the larger farms, while in cases where it is less than the true earnings the bias is in the other direction. It would appear that in this area and year efficiency in the use of horse labor was not nearly so important as efficiency in the use of man labor. The intensity of stocking (productive animal units) alone apparently had no effect upon labor income, although the type of livestock did. Proper utilization of farm area is apparently very profitable.

The study is offered as a guide to methods in the interpretation of factors which bear a mathematical relationship to other factors, and suggestions are made with reference to the further use of partial correlation analysis.

**A study of farm ownership in Massachusetts**, L. P. JEFFERSON (*Jour. Farm Econ.*, 5 (1923), No. 4, pp. 214-231).—The study reported upon in these pages was undertaken at the Massachusetts Agricultural College for the purpose of determining what had been the experience and training of the average Massachusetts farm owner. Schedules were obtained from 651 farmers, and the data presented here show the methods of acquisition of farms, the sources of purchase money and of loans, the income from farms, experience of the operators, farms previously owned by them, and the ages of farm owners. Certain explanations are given of the fact of the increasing age at which men become farm owners.

**Rural credit legislation**, W. F. MITCHELL (*Univ. Jour. Business*, 2 (1923), No. 1, pp. 1-21).—The importance to agriculture of intermediate credit and credit for purposes other than investment in the farm is briefly discussed, and the Agricultural Credits Act of 1923 is outlined. Other legislation dealing with warehousing, inspection, and the rediscounting of agricultural paper is discussed.

**"Picked pieces."**—The classification of a farmer's clip shown diagrammatically, G. L. SUTTON (*West. Aust. Dept. Agr. Bul.* 113 (1923), pp. 7, pl. 1).—The diagram presented herewith has been prepared to illustrate graphically how wool clips from different sized flocks should be prepared for sale.

**The internal grain trade of the United States, 1860-1890, I-III**, L. B. SCHMIDT (*Iowa Jour. Hist. and Politics*, 19 (1921), Nos. 2, pp. 196-245, 3, pp. 414-455, fig. 1; 20 (1922), No. 1, pp. 70-131).—In these three papers attention is directed first to the rapid expansion of the production of grain, second the geographic distribution of population and grain production, third the principal transportation routes connecting the surplus grain States of the North Central region with the consuming States of the East and the South, fourth the growth of the great primary markets of the Middle West, and fifth the movement of grain and flour from the primary markets to the Atlantic and Gulf ports.

**Interim report on cereals, flour, and bread**, LINLITHGOW ET AL. (*London: Min. Agr. and Fisheries*, 1923, pp. 100, pl. 1, figs. 2).—The departmental committee previously noted (*E. S. R.*, 50, p. 293) reports having held meetings and heard witnesses representative of farmers, corn merchants, millers, bakers, and consumers throughout Great Britain.

It is finally concluded that the farmer can not look for any immediate and material improvement in the prices he obtains for his wheat by alterations and economies in the established methods of production and distribution of either flour or bread. He should concentrate on the production of newly-evolved varieties of wheat of high milling quality. The creation of a demand for this is essential in order that he may obtain the higher price to which he will be fully entitled.



**Variations in the price of wheat flour in relation to those of wheat and of bran,** A. M. CONRAD (*Ann. Inst. Natl. Agron.*, 17 (1923), pp. 55-72, figs. 6).—A commission of 31 members was instructed on June 1, 1922, to make a study of the relation between the prices of wheat and of flour, bran, and other milling products in France. This investigation resulted in the law of July 15 and the decree of July 28, 1922, calling for the exclusive milling of whole wheat for human food and the creation of a special commission for control charged with regularly ascertaining the market price of wheat and of flour.

Numerous equations are derived and graphically presented bearing upon the relation of the quantity of flour to the wheat milled, the price of flour as determined by the assurance of a sale for secondary products such as bran, the market price of native wheat, the cost of milling and transportation and other general expenses, and the milling tax.

**Crops and Markets** (*U. S. Dept. Agr., Crops and Markets*, 1 (1924), Nos. 1, pp. 16, fig. 1; 2, pp. 17-32, fig. 1; 3, pp. 33-48, fig. 1; 4, pp. 49-64).—This publication succeeds *Weather, Crops, and Markets*, but does not contain the weekly weather reports. Abstracts of market information, notes on the position in the market of important classes of agricultural commodities, and tabulations of the weekly receipts and prices, with summaries and comparisons, are presented. Miscellaneous foreign crops and market notes are included in each number.

**Economic aspects of the problem of restoring the purchasing power of American farmers,** D. FRIDAY (*Econ. World*, n. ser., 26 (1923), Nos. 18, pp. 616-619; 19, pp. 654, 655).—The author points out a correspondence between the value of manufactures and the gross value of farm products between 1899 and 1919 and the increasing disparity from that time to the present. The real grievance of the farmer is held to be that he has lost some of the striking advantage which he gained in the 20 years culminating in 1919. Causes which carried prices of agricultural products upwards between 1899 and 1909 are reviewed as the rapid growth of population and increased output of manufacturing, stationary freight rates, and a stimulated foreign demand for farm products which raised American bidding for them. A movement of population from the farm to urban centers is held to be the salvation of the farming classes.

**Topical studies and references on the economic history of American agriculture,** L. B. SCHMIDT (*Philadelphia: McKinley Pub. Co.*, 1923, 2. ed., rev., pp. 126).—This is a revision, with additions, of a book previously noted (*E. S. R.*, 42, p. 286).

**Service relations of town and country,** J. H. KOLB (*Wisconsin Sta. Research Bul.* 58 (1923), pp. 78, figs. 24).—Dane County, Wis., was considered as a whole, and four towns in the eastern section of the county were first studied intensively in order to examine the tendency and forces which are reconstructing the relations between town and country. Of the 29 towns and villages exclusive of the city of Madison in Dane County, 23 perform at least five of the six fundamental services listed, namely, the economic including merchandising, marketing, and financing, the educational, the religious, the social, communication and transportation, and that of organization activity itself. Five types of service centers were found, including the single service, the limited simple service, the semicomplete or intermediate, the complete or partially specialized, and the urban and highly specialized types.

Examination was then made of the town as an aggregation of these service agencies, and the kind and number of agencies which tend to come together in a center of given size or character were classified. In this connection eight types of service agencies were separated, including those for merchandising;



trades and repairs; communication and transportation; personal and professional service; banking, insurance, or investment; religious service; educational service; and sociability, fraternal, or welfare activity. It is indicated that, on the whole, for every 100 people in and about the towns or smaller population there are more of the general commercial agencies than there are in towns of larger population. In 11 towns in this area there are more agencies per total population of the trades and repair, communication and transportation, finance, religion, and educational types for the towns of smaller size. Personal and professional agencies as well as social organization activity show the opposite tendency. Commercial and noncommercial agencies are grouped and discussed in detail.

In investigating the question of what are the factors determining the trading and the social habits of the farmer with reference to the nearby towns, 787 farm families were personally visited and questioned. These were distributed in three counties and over the general trade areas of six villages, towns, or cities. In Dane County four trade centers were selected which border upon one another and which lie within motoring distance of Madison. To act as a check for bringing out certain contrasts or comparisons, the Elkhorn trade area in Walworth County and the Waupaca area in Waupaca County were selected. Maps and tables are presented showing how far the town extends its services and the reasons given by farm families for buying specific kinds of merchandise in a certain center or for selecting a certain town for banking and marketing. The other services are analyzed in similar manner.

Certain competing service centers are noted, as well as the extent to which attempts have been made to develop and extend the service areas.

**The use of "pars" and "normal" in forecasting crop production, W. F. CALLANDER and J. A. BECKER** (*Jour. Farm Econ.*, 5 (1923), No. 4, pp. 185-197).—The term "forecasting" is used by the U. S. Department of Agriculture to refer to the "interpretation of current condition into probable yield on the basis of past relations for the particular date." Normal condition is synonymous with full condition, giving promise of a full yield per acre, and is the base upon which the reporter estimates percentages.

Some of the difficulties associated with the use of the average as the base or of a fixed normal are briefly discussed, and the value of crop condition estimates is set forth. The interpretation of the condition figures into a probable yield per acre is achieved mathematically, and there are established what the Department calls "pars," or the equivalent of 100. Pars adopted for use in each month in forecasting yields per acre are determined statistically from averages over periods of years of pars resultant from condition and yield.

Other methods of crop forecasting are briefly noted.

**Monthly Supplement to Crops and Markets** (*U. S. Dept. Agr., Crops and Markets*, 1 (1924), Sup. 1, pp. 40, figs. 3).—In this, the first supplement, are presented crop reports and tabulated monthly statistical summaries of production of specific crops; the current farm price tables; a report of the livestock and meat situation, November, 1923, with comparisons; statistics of the receipts and disposition at principal markets of livestock for December, 1922, and 1923; the cold storage report, January 1, 1924; and tabulated jobbing prices, carlot supplies, and total shipments of 12 leading fruits and vegetables for 1923, together with numerous special articles. Returns from recent surveys indicating the use of automobiles among farmers, a report of the December, 1923, pig survey, and notes with regard to the Hungarian and Austrian markets for American bacon and lard are featured.

**Statistical report of California dairy products, 1921-22, J. J. FREY** (*Calif. Dept. Agr., Div. Anim. Indus. Spec. Pub. 30* (1922), pp. 31).—The statis-



tics given in this report are based upon 1,241 individual reports submitted by the manufacturers for all dairy product plants in California. Besides statistics of quantity production, there is given a directory of such plants.

**Cuba as a market for American farm products**, L. M. PEREZ (*Bul. Pan Amer. Union*, 58 (1924), No. 1, pp. 12-15).—This is a review of statistics from United States official publications, showing the principal exports from the United States to Cuba in recent years.

**Canadian grain trade yearbook, 1922-23** (Winnepeg: W. Sanford Evans *Statis. Serv.*, [1923], vol. 3, pp. 80).—Canadian grain statistics covering production, shipments, supplies, and prices are tabulated, and summary tables for the principal foreign countries and the world production and movement are given.

**[Agricultural statistics for Sweden, 1922 and 1923]** (*Statis. Årsbok Sverige*, 9 (1922), pp. 68-91; 10 (1923), pp. 64-84).—These statistics add information for the later years to the series of reports previously noted (E. S. R., 45, p. 397).

**A brief survey of Italy's economic condition**, M. CASSIN (*Rome: Internatl. Chamber Com., Ital. Sect.*, [1923], pp. 71).—One section of this report is devoted to agriculture, and statistics of Italy's principal agricultural products, livestock, and livestock products are briefly reviewed.

**[Land tenure and settlement and agriculture in New Zealand]**, M. FRASER (*New Zeal. Off. Yearbook*, 30 (1921-22), pp. 289-343, figs. 3; 31 (1923), pp. 331-388, pls. 2, figs. 4).—New features which have been added to the reports on agriculture in these volumes of the series previously noted (E. S. R., 45, p. 895) are farm machinery and farm employees, the consumption of wheat, wheat control and guaranty, and census statistics of poultry and bees.

**Area, classification of area, area under irrigation, area under crops, livestock, and land revenue assessment in certain Indian States**, D. N. GHOSH (*India Agr. Statis.*, 36 (1919-20), II, pp. [3]+V+192, pl. 1).—Statistics of agriculture for the later year are added to the series previously noted (E. S. R., 46, p. 93).

**Agricultural statistics of India, 1920-21**, D. N. GHOSH (*India Agr. Statis.*, 37 (1920-21), I, pp. 4+IX+380, pls. 7; II, pp. II+V+205, pl. 1).—These reports, covering area, classification of area, area under irrigation and under crops, livestock, land revenue assessment, and harvest prices in British India and certain Indian States continue the statistical series previously noted (E. S. R., 47, p. 395) and noted above.

## AGRICULTURAL EDUCATION.

**The life and public services of Justin Smith Morrill**, W. B. PARKER (*Boston: Houghton Mifflin Co.*, 1924, pp. X+378, pls. 5).—This biography is discussed editorially on page 603.

**The teaching of agriculture**, A. D. HALL (*Jour. Min. Agr. [Gt. Brit.]*, 30 (1923), No. 9, pp. 798-806).—It is held that the agricultural college is dealing mainly with men who are going to be managers of labor, hence its object should be the training of managers. Teaching should be descriptive in the beginning and localized in its applications. The second and third years of work should include a consideration of broader economic questions and discussions of agricultural policy, as well as practical experience with planning the farm work and keeping books.

**Job analysis applied to the teaching of vocational agriculture**, V. C. GAINES (*Calif. Univ., Vocat. Ed. Div. Bul.* 8 (1922), pp. 41, fig. 1).—The scheme of analysis here presented is intended to lead the student to analyze the actual



problems making up his project, see the various educational factors that have a potent bearing on his particular problems, and give him training in the skills which make for success in carrying out the decisions which he may make. A class of 15 or 18 pupils beginning a course in plant production is assumed by way of illustration, and the development of project analysis is outlined. Further illustration is given in the case of the job of maintaining and improving the fertility of the soil. Suggestions are made as to teaching methods, and outlines of a number of jobs are submitted.

**The score card method of rating schools or departments of vocational agriculture in Missouri**, W. T. SPANTON (*Missouri State Bd. Vocat. Ed. Bul.* 11 (1923), pp. 48).—In order to replace the present system of supervision of agricultural education in the State, a score card was compiled more or less arbitrarily by the author. This was then submitted to a conference with two State supervisors and two professors of agricultural education at the University of Missouri. It was sent to 179 workers in agricultural education and discussed before five district or regional conferences, after which it was put to a test by State supervisors. As revised it consists of three parts, the vocational agricultural teacher, plant and equipment, and the status of vocational agriculture in the local community. The values assigned to these three main divisions are, respectively, 630, 250, and 120 points. The original and the revised score cards, an explanation of the terms used, and a bibliography of 25 titles are presented in appendixes.

**Rural welfare work of Mexican Government**, H. BOWYER (*Nation's Health*, 5 (1923), No. 2, pp. 69, 70, figs. 3).—A brief account is given of the work undertaken by the Mexican Department of Agriculture in the way of teaching rural hygiene and recreation.

**Social welfare work in rural Mexico**, H. BOWYER (*Bul. Pan Amer. Union*, 56 (1923), No. 5, pp. 453-458, figs. 7).—A description is given of the work of traveling rural instructors of sanitary housing, home hygiene, child care, food values, food selection, and home making, similar to the account given above.

**Agricultural education [in Northern Ireland]** (*North. Ireland Min. Agr. Ann. Gen. Rpt.*, 1 (1922), pp. 7-14).—The first report is made by the Ministry of Agriculture of the Government of Northern Ireland regarding itinerant instructors in agriculture, field and livestock experiments, demonstration plats, agricultural classes, and specific agricultural schools in this region in 1922.

**Biology of home and community**, G. H. TRAFTON (*New York: Macmillan Co.*, 1923, pp. X+614, pl. 1, figs. 214).—This outlines the study of specific forms of plants and animals, presenting also some general biology and simple classifications. It is designed as a textbook for use in the earlier years of a 4-year high school course in science.

**Corn and corn growing**, H. A. WALLACE and E. N. BRESSMAN (*Des Moines, Iowa: Wallace Pub. Co.*, 1923, pp. [3]+253, figs. 92).—This text has been designed for college and Smith-Hughes instructors. The chapters are arranged to present in order the history and importance of corn growing, the selection of seed corn, planting, cultivating, harvesting, and marketing the corn crop, corn-hog ratios, cost of production, and insect pests and diseases, concluding with the classification and botany of corn, corn judging, commercial products of corn, the geography of corn growing outside of the Corn Belt, and statistics.

**Cotton**, E. TURPIN (*New York: American Book Co.*, 1924, pp. VI+266, pls. 16, figs. 117).—The history of cotton growing and manufacture, the historical significance of cotton production in the United States and certain foreign countries, the uses of cotton and the life history of the cotton plant itself from seedtime to the picking and milling of the cotton, and the utilization of



seed and lint are put into this story of cotton, intended for use in elementary grades.

**Farm woodlands**, J. B. BERRY (*Yonkers, N. Y.: World Book Co., 1923, pp. [VI]+425, figs. 163*).—Several outlines of home projects in woodland forestry are presented in the first chapter of this textbook and handbook. The following chapters are devoted to the history and practice of forest management and the utilization of timber and wood, with particular reference to the farmer's interest in the utilization of waste land in the production of wood for fuel and repair purposes, in the establishment of windbreaks and shelter belts, in the planting of eroded slopes to prevent damage to more valuable land, and in the beautifying of the home grounds.

**List of references on home economics** (*U. S. Bur. Ed., Libr. Leaflet 21 (1923), pp. 21*).—An extensive bibliography prepared in the Library Division of the U. S. Bureau of Education lists general references on home economics, textbooks, and teaching suggestions for schools of various classes and pertaining to special subjects, and books on vocational aspects of home economics.

**Textile fabrics**, E. DYER (*Boston: Houghton Mifflin Co., 1923, pp. XIV+352, figs. 35*).—Early chapters of this textbook describe the manufacture of fabrics of wool, cotton, flax, and silk; principles of dress and design; and the selection of clothing. The textile fabrics used in home furnishing, the care to be given them, and the relation of textiles to the making of history are then discussed. Staple textile fabrics are catalogued, with brief descriptive notes. The appendix presents suggestions to teachers.

**Analysis of woven fabrics**, A. F. BARKER and E. MIDGLEY (*London: Scott, Greenwood & Son, 1922, 2. ed., rev. and enl., pp. XV+322, figs. 82*).—This is a treatise on the methods of weaving, dyeing, and finishing cloth, as well as of the analysis of woven fabrics, and includes a chapter on the cost of production.

**Home making in the part-time schools of New York**, T. E. KAUFFMAN (*Jour. Home Econ., 15 (1923), No. 8, pp. 421-423*).—Three courses for part-time schools are described as planned for groups of girls 14 years old or young girls electing commercial or industrial courses, 15 years old or older assisting in their own homes or working in homes other than their own, and 16 to 17 years old or older, respectively.

**Teaching child care to intermediate school girls**, C. M. FLANAGAN (*Jour. Home Econ., 16 (1924), No. 2, pp. 71-73*).—This is an outline for a series of eight 90-minute lessons planned as a unit to be given to seventh grade girls. Class projects, home work, and reading or thinking problems are suggested.

**An extension program in range livestock, dairying, and human nutrition for the Western States**, W. A. LLOYD (*U. S. Dept. Agr., Dept. Circ. 308 (1924), pp. 14, fig. 1*).—An extension conference, composed of the extension directors in Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Texas, Utah, Washington, and Wyoming; the livestock, dairy, and human nutrition specialists of these States; and representatives of the U. S. Department of Agriculture, was held at Fort Collins, Colo., November 5-9, 1923, with the view to developing an extension program. The material relating to range livestock, dairying, and human nutrition, assembled and organized in the U. S. Department of Agriculture by the range council, the bureaus and offices of the Department that had contributions to offer relating to human nutrition, and the Dairy Division, was presented to the conference. This, together with special reports and papers, was worked over and embodied in the reports of the range livestock, dairying, and nutrition committees, which are published here. It is expected that such phases of the program as the local conditions in each State, county, or community warrant and the existing extension organization can most effectively handle will be adopted.

**Young farmers' clubs**, E. H. PRATT (*Jour. Min. Agr. [Gt. Brit.]*, 30 (1923), No. 8, pp. 733-736, pl. 1).—The development of the young farmers' clubs movement in England since its institution in 1921 is noted. There are said to be 37 clubs in England and Wales, with a membership of over 600. Suggestions are offered as to the formation and organization of clubs.

### MISCELLANEOUS.

**The Office of Experiment Stations: Its history, activities, and organization**, M. CONOVER (*Inst. Govt. Research, Serv. Monog. U. S. Govt. No. 32* (1924), pp. XII+178).—This monograph is discussed editorially on page 606.

**Thirty-fourth Annual Report of Alabama Station, 1923** (*Alabama Sta. Rpt. 1923*, pp. 12).—This, the first report to be issued since 1920 (E. S. R., 44, p. 795), contains the organization list, a financial statement for the fiscal year ended June 30, 1923, and a report by the director on the work and publications of the year.

**Forty-sixth Annual Report of Connecticut State Station, 1922**, E. H. JENKINS ET AL. (*Connecticut State Sta. Rpt. 1922*, pp. XI+497+[4]+53, pls. 21, figs. 128).—This report contains the organization list, a report of the board of control, a financial statement for the fiscal year ended June 30, 1922, and reprints of Bulletins 240-249 and Bulletins 1-3 of the Tobacco Substation, all of which have been previously noted, and the first report of the Tobacco Substation, which is also issued as a separate.

**Thirty-fifth Annual Report of Massachusetts Station, 1922**, S. B. HASKELL ET AL. (*Massachusetts Sta. Rpt. 1922*, pts. 1-2, pp. [3]+25a+163, pls. 16, figs. 69).—Part 1 of this report consists of the organization list, a report of the director, a meteorological summary for the year, and a financial statement for the fiscal year ended June 30, 1922. The experimental work recorded and not previously reported is for the most part abstracted elsewhere in this issue.

Part 2 consists of reprints of Bulletins 207-212 and Technical Bulletin 5, all of which have been previously noted.

**Thirty-sixth Annual Report of South Carolina Station, 1923**, H. W. BARRE (*South Carolina Sta. Rpt. 1923*, pp. 74, figs. 22).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1923, and a report of the work and publications of the station during the year. The experimental features reported are for the most part abstracted elsewhere in this issue.



## NOTES.

---

**Delaware University and Station.**—Dr. E. M. R. Lamkey, plant physiologist and soil bacteriologist of the station, has resigned, effective July 31. A. E. Tomhave, instructor in animal industry, is to be transferred to the station July 1.

**Idaho University.**—F. E. Whitehead has been appointed extension entomologist and associate professor of entomology.

**Purdue University and Station.**—The university observed its semicentennial May 1-3 with appropriate exercises.

The Purdue Handbook of Agricultural Facts has been published recently by the station to meet the urgent demand of farmers, home makers, county and home demonstration agents, vocational and other teachers, farmers' institute workers, and others actively interested in agriculture for readily available and authentic information which will answer the many everyday questions on the farm and home problems of the State. The data are presented in a direct and brief form.

Recent appointments include Raymond H. Bamer as superintendent of the Pinney-Purdue Experimental Farm beginning March 1, T. Edward Hienton as assistant in rural engineering April 1, and Wayne E. Leer as State leader of barberry eradication vice Keller Beeson, who has been transferred to the soils and crops division of the department of agricultural extension.

**Kansas College and Station.**—A four-year curriculum in landscape architecture is to be offered for the first time in 1924-25, the technical subject matter to be given by the divisions of engineering and agriculture. Landscape gardening will continue to be offered in the division of agriculture as one of the groups of courses available for students working for the bachelor's degree in agriculture.

The annual ice cream scoring contests held at the college under the auspices of the department of dairy husbandry have resulted in a marked improvement in the quality of ice cream since these tests were begun in 1920. The average bacterial count this year was 150,000 per cubic centimeter as compared with more than 1,000,000 in 1923. One sample in the recent contest contained only 3,000 bacteria per cubic centimeter.

Ross J. Silkett, assistant in cooperative experiments, has resigned to accept a position at the University of Missouri. I. K. Landon has been appointed assistant professor of agronomy to have direct charge of the recently established outlying experimental fields in southeastern Kansas. Harry E. Reed has been appointed professor of animal husbandry in the college and sheep investigator in the station.

**Louisiana Stations.**—A. F. Kidder has resigned as agronomist, effective April 1.

**Michigan College.**—The extension work hitherto under the direct control of the State board of agriculture has been placed under the direction of the dean of agriculture, and its force will receive title and rank comparable to the remainder of the college staff.

The board has authorized the conferring of M. A. degrees on the same basis as that of master of science. Graduate work in the departments of history and political economy is contemplated.

The contract has been let for two greenhouses in connection with the new horticultural building. These greenhouses will be divided among several departments, one-quarter of the space being available for experimental work by the departments of soils, botany, and farm crops. Each house will be 216 ft. in length and 30 ft. wide.

**Rutgers College and New Jersey Stations.**—President W. H. S. Demarest has resigned, to take effect at the end of the academic year. R. E. Cray has resigned as assistant poultry specialist and S. W. Mead as instructor in poultry husbandry.

Recent appointments include Dr. Mintin A. Chrysler as associate professor of botany, Carl B. Bender as acting assistant dairy husbandman, Roland Chamberlain, Thomas C. Rogers, and Robert L. Starkey as research assistants in dairy husbandry, pomology, and soils, respectively, Bonnie Reid Fudge as assistant seed analyst, and Garrett J. Oldis as fertilizer and feed sampler.

A dahlia seedling trial garden is to be established on the station grounds in connection with the Dahlia Society of New Jersey.

**New York State Station.**—George A. Smith, for 23 years chief of the dairy division, died at Kingston April 19 at the age of 82 years. He had been long recognized as one of the pioneer progressive workers in the dairy industry in the State. In 1860 he began a successful career as cheese maker and became one of the recognized leaders in central New York, and he was one of the first dairy instructors to be appointed by the State dairy commissioner in 1888 to visit the cheese factories of the State and work with the cheese makers in order to improve the uniformity and quality of their product. In connection with this position he assisted in the work of the farmers' institutes as a speaker on dairy subjects, and in 1893 he became director of farmers' institutes.

In 1898 he was appointed to the newly established position of dairy expert on the station staff. This position was created as a result of his association as expert cheese maker with the extensive research work which the station began in 1891 and was held by him until his retirement in 1921. During his long service he was actively engaged in the experimental study of dairy problems in several lines. Besides cooperating in cheese and butter investigations, he was in charge of the station herd of dairy cows in connection with which striking results were achieved in the complete elimination of tuberculosis.

For many years Mr. Smith was also connected with the management of dairy exhibits at the State fair. In recognition of this experience he was made a member of the State fair commission in 1900 for eight years. He was active in making a success of the dairy exhibit of the State at the World's Fair at Chicago in 1893 and was in official charge of the station's dairy exhibit at the Buffalo Exposition in 1901. He was likewise president of the State dairymen's association from 1900 to 1904.

A statement drawn up by the station staff with reference to his work concludes as follows: "Owing to the wide reach of his activities in the State for so long a period of service, Mr. Smith had a personal acquaintance with individual farmers, especially dairymen, to an extent experienced by very few men. His friends were many. No one knew him but to respect him. He was known as a man of safe, conservative judgment, and was often consulted for advice in matters in which he had expert knowledge. In all his ways he was quiet, composed, and unassuming; always friendly and sympathetic. It was given to Mr. Smith as to very few men to experience so long a life of vigorous and helpful activities in so varied relations and to see so many useful results which his efforts aided in bringing about."

Guy F. MacLeod, assistant in research in entomology, resigned May 1 to accept a position with the Pennsylvania College.



**North Carolina College and Station.**—Melvin E. Sherwin, for 13 years head of the department of soils, died January 5 at the age of 42 years. He was a graduate of the University of Missouri and received the M. S. degree from the University of California in 1909. He had also served as assistant professor of agronomy at the University of Maine.

**Ohio Station.**—R. B. Wilcox, in charge of the investigations by this Department of raspberry diseases in Ohio, is to have his offices and laboratories at the station, beginning April 1, as well as a tract of land for experiments in disease control. A. Bonazzi, assistant in soil technology, and T. C. Green, assistant in soils, have been granted six months' leave of absence in order to organize a soils experimental department for a Cuban sugar company.

William A. Simkins has been appointed assistant in chemistry, Paul E. Tilford assistant in plant pathology to give special attention to diseases of the potato, G. H. Stringfield assistant in agronomy to engage in plant breeding work, and F. S. Howlett assistant pomologist.

**Oklahoma College and Station.**—George W. Cochran, assistant professor of horticulture at Purdue University, has been appointed head of the department of horticulture, effective April 14.

**Pennsylvania College and Station.**—The department of horticulture has recently entered into a cooperative agreement with the Marble Laboratories, Inc., of Canton in an investigation of the relation of cultural methods and growth conditions to the keeping quality of apples. The experimental orchards both of the college and the laboratory will be available for this project, which will be financed entirely by the latter. Dr. R. D. Anthony of the college will have general supervision of the project, with one or more assistants to be stationed at Canton where a storage laboratory built and equipped at an expense of more than \$150,000 is available.\*

I. D. Wilson, professor of veterinary science, E. M. Christen, assistant professor of animal husbandry extension, and H. W. Cook, assistant in agronomy extension, have resigned. Recent appointments include H. G. Niesley as professor of agricultural economics extension and the following assistant professors: Hilbert E. Dahl in landscape architecture, Frank T. Murphey in forestry extension, J. F. Shigley in veterinary science, W. T. Tapley in vegetable gardening, L. C. Madison in animal husbandry extension, John C. Taylor in poultry husbandry extension, and R. S. Kirby in plant pathology extension. R. G. Bressler has been designated vice dean and director of instruction in the school of agriculture.

**Texas College and Station.**—In accordance with a special appropriation of \$50,000 by the legislature for the establishment of a horticultural and agricultural experiment station in the lower Rio Grande Valley, a substation designated as Substation No. 15 has been located in Hidalgo County. A site of 100 acres of excellent land with an adequate supply of water for irrigation purposes has been acquired, a superintendent appointed, and development work begun. Provision has also been made for a substation near Wichita Falls in Wichita County.

The *Journal of Farm Economics* notes that P. K. Whelpton has resigned as professor of farm management to accept an appointment with the Scotland Foundation for Research in Population Problems at Miami University. His work will deal with agricultural phases of the problem.

**Utah College and Station.**—By recent action of the board of trustees, the station and the extension service were combined under William Peterson, for the past three years director of the station.

A plant to be used in an egg-laying contest is now being erected at the station and is expected to be ready for use by November 1. The equipment

will accommodate 50 pens, each containing 10 contestant hens and 2 alternates to be used in case of accident.

An 80-acre farm suitable for the running of dairy production experiments has been leased, and a modern dairy barn that will accommodate 30 cows is being built, to be ready for use June 1. This plant will make it possible to carry on some much needed studies in feeding and managing dairy herds.

**West Virginia University.**—James V. Hopkins has been appointed dairy extension specialist.

**Model Farm in Panama.**—A contract has been drawn up between the secretary of public works of the Panaman Government and Walter C. Staton for the operation of a model farm in the District of Alanje, Chiriqui Province, where 18 students, 2 from each province, are to receive instruction in agricultural pursuits. Cultivation and improvement in methods of raising rice, corn, beans, sugar cane, bananas, tobacco, and other tropical fruits and vegetables, as well as feed and forage for cattle, are among the principal subjects in which instruction is to be given. Attention will also be given to proper methods of caring for livestock and the use of modern agricultural machinery.

Under the terms of the contract, which is for the period of one year from April 15, 1924, but renewable for an additional five years, the contractor is to receive the sum of \$36 a month for each student.

The Government reserves the right to establish an agricultural experiment station, not to exceed 10 hectares (about 25 acres) in area, within the limits of the model farm and to place in charge an expert to be named by the Government, if desired.

**Northeastern Forest Research Council.**—This body was organized April 3 at the Northeastern Forest Experiment Station located at the Massachusetts Agricultural College. The membership includes S. T. Dana, the director of that station; the directors of the New Hampshire and Connecticut Agricultural Experiment Stations, the Harvard Forest, and the Yale School of Forestry; and representatives of the Massachusetts Agricultural College, the New York State College of Forestry at Syracuse University, and the New York State College of Agriculture at Cornell University; the State forester of New Hampshire; and various wood-using and timber-owning agencies of the region. E. H. Clapp, assistant forester in charge of the research branch of the Forest Service, is the representative of the U. S. Department of Agriculture. The purpose of the council, as previously explained (E. S. R., 49, p. 402), is to act in an advisory capacity for the forest experiment station and other forest research agencies in New England and New York and to aid in securing the adoption of a comprehensive, well conducted, and effective program of forest research.

**Miscellaneous.**—The third Pan American Scientific Congress will be held in Lima, Peru, beginning November 16. One of the nine sections will deal with biology, agriculture, and related sciences.

Dr. Robert Tigerstedt, professor of physiology at Helsingfors University and widely known for his researches on metabolism, died December 2, 1923, at the age of 70 years.

---

ADDITIONAL COPIES  
OF THIS PUBLICATION MAY BE PROCURED FROM  
THE SUPERINTENDENT OF DOCUMENTS  
GOVERNMENT PRINTING OFFICE  
WASHINGTON, D. C.  
AT  
10 CENTS PER COPY  
SUBSCRIPTION PRICE, 75 CENTS PER YEAR



# EXPERIMENT STATION RECORD.

VOL. 50.

JUNE, 1924.

No. 8.

The increasing disposition to look to organized experimentation for the solution of many of the world's agricultural problems becomes more and more readily demonstrated. It is a result in part of the many tangible successes which have been attained by agricultural research institutions in their comparatively short history, and it is a recognition of their important function in the national economy. It indicates the deepening realization that expenditures for research purposes are in the nature of permanent investments, and moreover investments of a character wherein the returns from one discovery may be so large as to far more than compensate for even a considerable number of unproductive ventures.

As a conspicuous example of large-scale operations centering around a single commodity, there may be cited the efforts under way in the British Empire to promote cotton production and the increasing reliance being put upon research as a factor in that program. The importance of such an undertaking from the standpoint of the British Empire is readily appreciated. As was stated by Viscount Milner some time ago, "Our manufacturing industries at home are in constant need of raw materials. This is peculiarly the case with cotton; indeed the world is threatened with a great shortage of this staple, and in many other industries the amount of raw material required is increasing day by day. The demand is great, not only in our country but on the part of our allies, and our late enemies as well. They all look to the British Empire to supply them, and it is obviously of the first importance that we should meet their demand to the utmost of our power. . . . But when dwelling upon the great potentialities of the empire in this respect, we must always bear in mind that a vigorous policy of development is necessary if we are to realize them."

Since 1900, the world's consumption of cotton has been increasing at a faster rate than production, because of the enlarged demands of manufactures in the United States, Canada, Japan, and India, and reduced acre yields in the United States and Egypt. The decrease in Egypt, formerly considered a part of the British Empire, is ascribed to reduced soil fertility, poor drainage, inadequate fer-

tilizing, the pink bollworm and other insect pests, use of an earlier but less productive variety, and agrarian disturbances. The main causes for the decline in the United States during the last decade have been the spread of the boll weevil and labor shortage. The most serious feature of the United States supply has been held to be the tendency to violent fluctuations, caused by reactions of prices on the area planted, weather damage during prolonged picking periods, and the speculative nature of the crop. Diversification has made restriction of the cotton area economically feasible, while high labor costs render cotton growing unattractive or even impossible at prewar prices. Conditions such as prolonged picking periods, poor baling and compressing, and insect pests have tended to depreciate uniformity and quality, so important to the spinners of England.

The gradually reduced production in the regions long reputed as dependable commercial cotton growing areas has caused much active interest to be taken, especially by the British, in developing new cotton-growing districts in different parts of the world. Extension of the cotton industry into new regions of the empire has been difficult. Among the important factors to be considered are climate, labor, transportation, and finance, and the expansion of the industry calls for intensive study of the human elements and economic conditions involved, as well as the agricultural and environmental factors.

These conditions have been becoming more and more generally recognized, but their economic aspect has perhaps been most acutely realized in England, where an adequate supply of raw cotton has for generations been regarded as scarcely less essential in the economic structure than a sufficiency of food. The policy of developing a cotton supply grown within the empire itself has been steadily gaining in favor, and as early as 1902 the British Cotton Growing Association was formed at Manchester at the instance of Lancashire chambers of commerce and West African merchants at Liverpool for this specific purpose. The association was granted a royal charter in 1904, and includes in its membership spinners, manufacturers, merchants, shippers, and representatives of the different industries and labor bodies connected with the cotton trade.

Financial assistance has been given the association by a number of local governments on the condition that the association spend an equal amount in cotton growing and experimental work. Grants from the Imperial Treasury have been conditioned on spending the money in special districts approved by the Government, which recognized the value of the project, especially in developing the resources of the colonies. Some of the islands of the West Indies, dependent at one time on imperial grants for financial support, be-



came very prosperous following the efforts of the association. Where several years ago grants of between £600,000 to £700,000 were made from the Imperial Treasury for the colonies and protectorates of Nigeria, Uganda, Nyasaland, and the West Indies, in 1921 these grants were practically if not wholly canceled, chiefly because of increased revenues due to cotton growing.

The principal empire cotton fields are India, the Sudan, Nigeria, Uganda, Nyasaland, and the West Indies. In all of these the work has now passed the preliminary stage, and the association's activities now consist in developing these countries.

Several years ago it was felt that much greater efforts were needed to make more rapid progress with cotton growing in various parts of the empire if the country was to obtain any large returns. As a result of appeals to the Prime Minister, the Empire Cotton Growing Committee, representing both Government departments and the cotton trade, was appointed in 1917 under the chairmanship of Sir Henry Birchenough to investigate the best means of developing the growing of cotton within the empire and to advise the Government as to the necessary measures to be taken for this purpose. The report of this committee, rendered in October, 1919, after nearly three years of investigations, gave detailed information on cotton production within the empire and on the needs of the industry and the serious nature of some potential dangers. Among its recommendations were those looking to the enlargement and strengthening of the agricultural departments in British colonies and dependencies and the establishment of a central research institute and of a bureau of information on cotton growing. In order to increase the supply and improve the training of scientific men capable of studying cotton, the committee advised the creation at British universities of readerships in plant physiology, plant genetics, mycology, and entomology, and also the institution of research studentships to be held by graduates. It was also suggested that the British Cotton Growing Association act without profit or loss as the agent of the committee for marketing crops where this was agreeable to the local government.

To establish a permanent body to carry out these recommendations the Empire Cotton Growing Corporation was formed under royal charter granted in November, 1921. It includes representatives of the Governments of England, India, South Africa, and Australia, of the cotton industry at home and in India, of chambers of commerce, of the British Cotton Growing Association, and of other bodies interested in cotton growing on either the scientific or commercial side. The corporation may be described as analogous to an information and spending department, without Treasury control but under the direction of its own finance committee. It has an

assured income devised partly from a capital contribution of nearly £1,000,000 made by the Government, and partly from a compulsory levy of 6d. per standard bale on all raw cotton purchased by spinners in England.

Special reports have been made by this body on the possibility of developing cotton production in Nigeria, Tanganyika, Nyasaland, western Australia, and Queensland. Students have been trained in increasing numbers, and assistance of a practical nature has been given the Sudan Government, which is engaged in the development of an irrigation project.

An interesting event recently chronicled in *Nature* was the return of Sir John Russell, director of the Rothamsted Experimental Station, from a mission to the Sudan, in which he was associated with Dr. H. Martin Leake, director of agriculture for the United Provinces of India, in advising the Sudan Government as to the organization and direction of agricultural research to be undertaken in connection with irrigation projects in the Gezira plain south of Khartum. In view of the enormous possibilities for growing cotton in this region, the research work will be mainly concerned with this crop. The first installment of this great project is expected to come into operation in the fall of 1925, when 300,000 acres will be put under irrigation, of which one-third will be in cotton. The complete project is estimated to be capable of development over an area of 3,000,000 acres and may ultimately produce 1,000,000 bales of cotton a year. It is anticipated that the Empire Cotton Growing Corporation will cooperate with the Sudan Government in the research work projected, and that this work can be coordinated with a general plan for research work on cotton problems to be organized throughout the British Empire.

Another phase of cooperation in the industry is in the matter of scholarships. The Empire Cotton Growing Corporation has recently made grants of £1,000 to each of five institutions for five years, to be used for the development of research likely to be of importance in relation to problems connected with cotton growing. One of these institutions is Rothamsted, where the funds are to be used in increasing the staff and equipment of the soil physics department and for special studies of water relationships in districts where cotton is grown. Another is the University of Manchester, where the grant will be used to promote research in mycology and entomology, particularly as to fungus diseases of plants likely to be of importance in cotton growing. Likewise, the corporation is sending four postgraduate students to the Imperial College of Tropical Agriculture for special research work in genetics and plant breeding, while the Indian Central Cotton Committee is



financing six scholarships for qualified graduates of Indian universities to enable them to prepare for research work under the direction of experienced investigators.

The Imperial Institute, located in London, has, since its reorganization as a Government institution in 1903 as a center and clearing house for information and investigation for the commercial development of the natural resources of the empire, continuously promoted the interests of British cotton cultivation as one of its major activities. This has been done mainly by conducting investigations respecting the quality of cotton grown in cooperation with the agricultural departments of the countries concerned and with the British Cotton Growing Association, by collecting and publishing information respecting the progress of cotton growing in all countries, and by arranging and maintaining reference collections of cottons from every country of the empire. Numerous reports have been made to the local governments, to planters, and others respecting the quality and commercial value of cotton grown, the soil and its fertilizer needs, the types of cotton most likely to be suitable for trial in particular countries, the supply of seed and methods of seed disinfection, and the treatment required for insect pests and plant diseases. Much information has also been supplied concerning the methods of improvement of varieties of cotton by seed selection, by breeding, etc. Information has been systematically collected and arranged from publications respecting cotton cultivation in every part of the world, and also considerable data obtained by special application to governments and planting companies. Besides publishing a number of special reports and papers on cotton production, the institute has presented in its quarterly bulletin a comprehensive list of special articles on cotton and cotton production throughout the world.

The investigational work has chiefly consisted in examining samples of experimentally grown cotton, mainly as to length and strength of fibers and its suitability for special purposes in comparison with other cottons or with the same type of cotton grown in other countries. This work has been carried out in collaboration with the local agricultural departments, whose efforts have been directed to secure the type of cotton best adapted to the particular country and its improvement by various means. Numerous analyses of cotton soils have been conducted before and after experimental manurial treatment. The commercial value of various experimentally grown cottons has also been determined by reference to manufacturers as well as to brokers, and this section of the work has been carried on in close cooperation with the British Cotton Growing Association.



The field of cotton technology has also been given special attention by the British Cotton Industry Research Association, incorporated in 1919. The council of this association is composed of representatives of all sections of the cotton industry, of trade associations, and of science. The need of an institution where all the sciences involved would be represented and could work in close cooperation was soon realized, and research laboratories at Shirley Institute, Manchester, were formally opened in 1922.

A broad view regarding the scope of the projected research has been taken by the council, and, as indicated by the program of research formulated by the research committee for the general guidance of the director and research staff, the work provided for is of a fundamental nature. Investigations in progress concern the life history and properties of the cotton fiber and research into the chemical and physical changes introduced during manufacture. These studies are deemed essential as a guide to the users of the fiber in conjunction with the investigators in suggesting improvements in present processes and machinery.

The study of the botanical, chemical, and physical properties of the single cotton fiber is fundamental to the entire industry. The botanical aspect is also concerned with the conditions of growth and breeding of the cotton plant, as far as these affect the quality of the raw material. Projects recently reported on concern the structure of the cotton fiber and its botanical aspects; the rigidity, clinging power, and convolutions of the cotton fiber; the measurable characters of raw cotton, including determination of area of cross section, fiber weight per centimeter, cell diameter, and breaking load of single fibers; mechanical testing of cotton materials; and the inheritance of characters in the plant. Some of the work is a continuation of the elaborate studies begun by Balls in Egypt.

The general purpose of the technological research in cotton spinning as now being conducted in England is to achieve a better understanding of cotton as a raw material and of what happens when it is spun. The sizing problem is also considered important, and other major problems which may be mentioned include the effect on the fiber of water and of steam at different pressures and the tendering of fibers and fabrics by acids, light, and heat.

Confronted with these problems, the association has felt the need of a vast amount of purely scientific work of a type such as in the past has been restricted almost wholly to the universities. This work the association expects these institutions will continue, and it also looks to them for the training of skilled research workers, hoping that the ties between the scientific workers and industry may become closer in the future. The director of research, A. W.



Crossley, has aptly stated: "The relationship with pure science cannot, however, be strengthened by a policy of the purely 'take and be thankful' type; something must be given in return; and it is hoped that science will be enriched by the publication of the pure scientific research carried out in the Shirley Institute."

The work thus far undertaken has naturally centered quite largely about India. This country, with an annual yield of over 4,000,000 bales on a little more than 22,000,000 acres, is second in cotton production only to the United States and possesses distinctive advantages and handicaps. Cotton is picked every month of the year in some parts of India, but the acre yields are low and numerous pests, including the pink bollworm, take a heavy toll. The major portion of the Indian crop is of very short staple and does not compete with the best American or Egyptian growth in the cotton mills of either Europe or the United States.

In 1917 the Indian Cotton Committee was appointed by the Governor General of India to examine into the agricultural and economic phases of long staple cotton production in India. In its comprehensive report this committee recommended the establishment of a central cotton trade association in Bombay and the formation of a central cotton committee to coordinate all work with cotton throughout India. The Indian Central Cotton Committee was constituted by resolution of the Government of India in 1921 and continued as an advisory committee for about two years. It was then incorporated under the Indian Cotton Cess Act of 1923 as a permanent body with a definite constitution, funds of its own derived from a levy on the crop, and authority to undertake specific work for the improvement of cotton growing. The personnel provided for includes the agricultural adviser to the Government of India, the director general of commercial intelligence, and representatives of chambers of commerce, mill owners' associations, the Empire Cotton Growing Corporation, cotton growers, cooperatives, the Indian States, and the cotton manufacturing and ginning industry. Provincial and local cotton committees have been formed in most of the provinces.

Aside from its more formal activities, the committee is a central body charged with the promotion of all measures which will aid the improvement of the Indian cotton growing industry. Its representative character not only qualifies it to advise the central and provincial governments in matters concerning the industry but also affords a common meeting ground for all sections of the trade with the agricultural departments, which enables difficulties to be discussed and joint action taken for the common good.

During the year ended August 31, 1923, the committee considered the regulation of transportation of cotton and of gins and presses, open cotton markets, cleaner packing, marketing arrangements with the East India Cotton Association, mixing of Punjab-American cotton, and precautions against introduction of the boll weevil and other pests. Grants have been made for research in Bombay on the physiology of the cotton plant, especially boll shedding, studies on wilt and the spotted bollworm, and improvement of varieties; in Madras for plant breeding work on herbaceous cottons and biochemical investigations to determine causes for variations in yields and resistance and susceptibility of the strains to pests and diseases; in the Punjab for investigations of the isolation of pure types and a general physiological study of the growing of American cotton under canal irrigation, especially regarding water requirements and the causes of losses by shedding of buds, flowers, and bolls; in the Central Provinces for breeding for better staple; and in the United Provinces for studies on the control of pink bollworm.

A central agricultural research institute has been proposed by the committee to be supported by annual subsidies from the Central Indian States and the site to be given by Indore, with the committee providing for a capital grant and annual expenses. Indore is considered an excellent situation for investigations of a group of problems connected with cotton growing, being in what is practically the only large homogeneous cotton tract in India. A technological laboratory near the Victoria Jubilee Technical Institute at Bombay is contemplated to provide for accurate spinning trials on new cottons for agricultural departments. A study of the intrinsic spinning characters of Indian cotton and their correlation with measurable physical characters is regarded as an essential complement to the plant breeding work now carried on by the departments and as a basis for the reform of trade classification of cotton and an improved marketing system.

This survey, while obviously incomplete, indicates the serious attention which is being given the cotton situation in the British Empire. Taken collectively, the efforts under way probably constitute one of the largest organized enterprises centered about a single commodity thus far attempted. It is therefore fortunate that the necessity of research as the foundation of the elaborate program in contemplation is so clearly and so generally recognized. The steady progress which is being made in coordinating and correlating the wide range of interests concerned is also quite significant, and these conditions collectively augur well for an ultimately successful outcome.



## RECENT WORK IN AGRICULTURAL SCIENCE.

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

**Organic syntheses**, edited by H. T. CLARKE ET AL. (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1923, vol. 3, pp. V+104, figs. 3*).—This volume, which continues the series previously noted (*E. S. R.*, 48, p. 501), contains directions for the preparation of 30 organic compounds. A collective index of the three volumes now issued is included.

**Differential equations in applied chemistry**, F. L. HITCHCOCK and C. S. ROBINSON (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1923, pp. VI+110, figs. 15*).—The essentials of differential calculus as applied to the solution of chemical problems are presented briefly, with selected problems illustrating processes of the first and second order, simultaneous processes, equations of flow, and the graphical evaluation of integral expressions.

**Fundamental principles of colloid chemistry and their application to biology and medicine**, H. HANDOVSKY (*Grundbegriffe der Kolloidchemie und Ihre Anwendung in Biologie und Medizin. Berlin: Julius Springer, 1923, pp. [5]+65, figs. 6*).—This is a brief introduction to colloid chemistry as applied to biology and medicine.

**Marine products of commerce**, D. K. TRESSLER (*New York: Chem. Catalog Co., Inc., 1923, pp. 762, figs. 257*).—In the preparation of this treatise on the fishery industries, the author has had the collaboration of various specialists who have contributed the following chapters: The refining of sea salt and the recovery of by-products from bittern, by D. K. Tressler, C. Elschner, and G. B. Willcox; pearls and the pearl industry, mother-of-pearl and blister pearls of marine origin, and the precious coral industry, by G. F. Kunz; characteristics of marine fishes, by S. F. Hildebrand; the importance of the fisheries and fishery methods and gear, by L. Radcliffe; refrigeration and cold storage of fish, by H. F. Taylor; canning of fish and fish products, by H. M. Loomis; manufacture of leather from marine sources, by A. Rogers; the world's oyster industry, by J. S. Gutsell; the American shrimp industry, by A. Orr; seals and walruses, by W. T. Bower and E. C. Johnston; and commercial sponges, by H. F. Moore.

The remaining 23 chapters, written by the author, include the manufacture of salt from sea water and of iodine and potash from seaweed and kelp; edible algæ; the composition and nutritive value of fish; the principles of preservation of fish by salting, smoking, drying, and pickling; fish by-products, including fish and liver oils, fish scrap fertilizer, fish meal, fish glue and isinglass; the clam, shrimp, and miscellaneous shellfish industries of the United States; and the whaling industry.

Following each chapter is a list of additional literature references. Statistics of fishery products for the United States by States and a list of common names and descriptions of marine fish and animals of commercial importance of the United States and Alaska are given as appendixes.

**Chemistry in the cereal industries**, C. H. BAILEY (*Indus. and Engin. Chem.*, 15 (1923), No. 9, pp. 900, 901).—A brief outline is given of the various phases of cereal chemistry.

**Chemistry in the control of plant enemies**, W. C. O'KANE (*Indus. and Engin. Chem.*, 15 (1923), No. 9, pp. 911-913).—This is a brief discussion of some of the recent developments in the application of chemistry to the destruction of plant enemies, with suggestions as to problems still unsolved.

**Chemical, physical, and biological properties of Bordeaux mixtures**, O. BUTLER (*Indus. and Engin. Chem.*, 15 (1923), No. 10, pp. 1039-1041).—A brief history is given of the development of Bordeaux mixtures and of chemical, physical, and biological studies conducted on them.

**Powdered Bordeaux mixture**, R. H. ROBINSON (*Indus. and Engin. Chem.*, 15 (1923), No. 9, pp. 941, 942).—In studies reported from the Oregon Experiment Station, it was found that a satisfactory Bordeaux mixture could be prepared at the time of application by the addition to a suitable volume of water, of powdered copper sulphate, followed by hydrated lime containing a small amount of an organic stabilizer such as casein. It is recommended that cartons be prepared containing the requisite amount of powdered copper sulphate and hydrated lime in separate packages. Suggested directions to be printed on the cartons are as follows:

"First, fill the spray tank with 50 gal. (for 4 lbs. lime and 4 lbs. of copper sulphate) of water. After starting the agitator add contents of package A (containing copper sulphate). Then sift into the tank package B (containing the hydrated lime plus 0.01 per cent of casein). The Bordeaux mixture is then ready for spraying."

**The distribution of sulphur in protein-free milk**, B. SURE and R. E. O'KELLY (*Jour. Metabolic Research*, 3 (1923), No. 2, pp. 365-371).—Data on the distribution of sulphur in three samples of protein-free milk from three different breeds of cows are summarized in the following table:

*Distribution of sulphur in protein-free milk.*

Sam- ple num- ber.	Breed of cow.	Total sulphur.	Total sulphate.	Inor- ganic sulphate.	Ethereal sulphate.	Organic sulphate.	Per cent of organic sulphur of total sulphur.
I	Holstein.....	<i>Per ct.</i> 0.141	<i>Per ct.</i> 0.041	<i>Per ct.</i> 0.021	<i>Per ct.</i> 0.020	<i>Per ct.</i> 0.100	71.5
II	Ayrshire.....	.110	.026	.017	.009	.084	76.4
III	Jersey.....	.135	.046	.019	.027	.089	65.9

The high proportion of organic sulphur is thought to point to the probability, as suggested in a previous paper (E. S. R., 44, p. 462), that the supplemental value of protein-free milk for protein from different sources may be due in part to the organic sulphur. This may be in the form of cystin or some organic sulphur compound which the animal organism can readily transform into cystin.

**Some basic substances from the juice of the alfalfa plant**, C. S. LEAVENWORTH, A. J. WAKEMAN, and T. B. OSBORNE (*Jour. Biol. Chem.*, 58 (1923), No. 1, pp. 209-214).—A larger quantity of alfalfa juice than was available at the time of the previous study (E. S. R., 48, p. 201) was examined for basic substances.

The filtrate from the precipitate produced by adding 53 per cent by weight of alcohol to 3,415 cc. of alfalfa juice was concentrated, boiled with 25 per cent sulphuric acid for 12 hours, and the basic products of hydrolysis precipi-



tated with phosphotungstic acid. Using Kossel's method of determining basic amino acids, arginin, identified as the picrolonate, was obtained from the silver-baryta precipitate to the extent of 3.6 per cent of the nitrogen of the filtrate from the 53 per cent alcohol precipitate. The precipitate produced by mercuric sulphate contained nitrogen equal to 2.2 per cent of the total nitrogen of the original solution, but was not identified. It did not give the reaction with diazobenzenesulfonic acid characteristic of histidin.

The filtrate from the silver-baryta precipitate contained stachydrin in much larger amounts than lysin, the nitrogen being 5.4 and 1.16 per cent, respectively, of the total nitrogen of the filtrate. These bases were separated by means of mercuric chlorid, the fraction obtained at acid reaction consisting almost entirely of the mercury salt of stachydrin, while that precipitated at alkaline reaction contained the mercury compound of lysin. The presence of stachydrin confirms Steenbock's discovery of this betain in the water extract of alfalfa hay (E. S. R., 39, p. 610).

**Formation of maltose in sweet potatoes on cooking,** H. C. GORE (*Indus. and Engin. Chem.*, 15 (1923), No. 9, pp. 938-940; also in *La. Planter*, 71 (1923), No. 22, pp. 433, 434; *Facts About Sugar*, 18 (1924), No. 4, pp. 88-90).—In this contribution from the Bureau of Chemistry, U. S. D. A., it is shown that maltose is formed in large quantities in sweet potatoes on cooking, that this formation is due to the action of diastase since it does not occur at the boiling point, and that the action while not instantaneous is very rapid. Data are given on sugar formation in different varieties of sweet potatoes when cooked in different ways and on the preparation of crystalline maltose from baked sweet potatoes of the Nancy Hall variety. The extent of maltose formation is shown by the fact that 8.59 per cent by weight of the baked sweet potato, equal to 6.71 per cent of the weight of the fresh potato, was recovered in the form of crude crystalline maltose.

Among the practical bearings of these observations are the possibility of developing sweet potatoes most suited for table use by selecting varieties having the highest diastatic power, the selection of methods of cooking or canning sweet potatoes to develop the highest content of sugar in the cooked product, the application of the knowledge of the high diastatic power of sweet potatoes to methods of sirup making (E. S. R., 49, p. 506), and the utilization of sweet potatoes as an industrial source of diastase.

In considering the sweet potato as a food, it is suggested that "since upon cooking sweet potatoes at least half, and frequently nearly all, of the starch present becomes converted into sugar, our concept of the sweet potato as a starchy food should be revised, since when consumed by man it really is saccharine rather than starchy."

**Proteins of wheat bran.—I, Isolation and elementary analyses of a globulin, albumin, and prolamins,** D. B. JONES and C. E. F. GERSDORFF (*Jour. Biol. Chem.*, 58 (1923), No. 1, pp. 117-131).—This contribution from the Bureau of Chemistry, U. S. D. A., consists of the report of the separation and analysis of the proteins of pure wheat bran, the term bran being used to include "the outer seed coats, together with the underlying layer of cells which contains the protein, and which in the milling process is removed with, and is firmly attached to, the outer seed coats."

By successive extraction of the thoroughly washed, dried, and ground bran with distilled water, 4 per cent sodium chlorid solution, 70 per cent alcohol, and 0.5 per cent sodium hydroxid solution, 86.61 per cent of total protein in the bran was extracted. This consisted of albumin 16.64, globulin 13.62, and alcohol-soluble protein 31.01 per cent. The elementary percentage composition of these proteins is given as follows: Albumin, N 15.42, C 53.21, H 6.71, S 1.35;



globulin, N 17.76, C 53.43, H 7.40, S 0.91; and alcohol-soluble protein, N 15.35, C 54.25, H 6.75, and S 1.35.

**The occurrence of polypeptids and free amino acids in the ungerminated wheat kernel,** S. L. JODIDI and K. S. MARKLEY (*Jour. Amer. Chem. Soc.*, 45 (1923), No. 9, pp. 2137-2144).—The ungerminated kernels of four varieties of wheat—Kanred, Fultz, Marquis, and Kubanka—were analyzed for nonprotein nitrogen with the following results, given in the above order of varieties: Peptid nitrogen 26.86, 28.09, 32.20, and 37.76 per cent, respectively, on the basis of the water-soluble nitrogen, and 3.89, 4.67, 4.98, and 5.13 per cent calculated to the total nitrogen; free amino acid nitrogen (in round figures) 10, 11, 11, and 16 per cent and 1.4, 1.8, 1.8, and 2.3 per cent, calculated to the water-soluble and total nitrogen, respectively; and acid amid nitrogen 8.76, 12.33, 12.61, and 12.99 per cent and 1.46, 1.91, 1.72, and 1.88 per cent, calculated to the water-soluble and to the total nitrogen, respectively.

**Influence of starch on strength of wheat flour,** J. H. BUCHANAN and G. G. NAUDAIN (*Indus. and Engin. Chem.*, 15 (1923), No. 10, pp. 1050, 1051).—A comparison is reported of the size of starch grains in different samples of wheat flour and the loaf volumes of bread made from these flours under uniform conditions. The data reported indicate that a relationship exists between the strength of the flour as shown by loaf volume and the size of the individual starch grains, the smaller the grains the stronger the flour.

**Determination of ash, arsenic, copper, and zinc in gelatin,** R. M. MEHURIN (*Indus. and Engin. Chem.*, 15 (1923), No. 9, pp. 942, 943).—The method employed in the meat inspection laboratories of the Bureau of Animal Industry, U. S. D. A., for the determination of small quantities of ash, arsenic, copper, and zinc in gelatin is described in detail.

**The preparation of insulin,** C. H. BEST and D. A. SCOTT (*Jour. Biol. Chem.*, 57 (1923), No. 3, pp. 709-723).—A brief historical review is given of attempts to prepare active pancreatic extracts prior to the discovery of insulin. This is followed by descriptions of the methods successively employed in the Toronto and other laboratories for preparing insulin and a detailed description of the method in use at Toronto at the time of writing. The yields of insulin obtained by the various methods are compared briefly.

**Chemistry of wood.—VI, The results of analysis of heartwood and sapwood of some American woods,** G. J. RITTER and L. C. FLECK (*Indus. and Engin. Chem.*, 15 (1923), No. 10, pp. 1055, 1056).—This continuation of the studies previously noted (*E. S. R.*, 48, p. 416) consists of analyses by the same methods of the heartwood and sapwood of representative softwoods and hardwoods to determine whether there is any uniform difference in the chemical composition of sapwood and heartwood.

The data obtained show that in softwoods the water, ether, and alkali extracts are higher and the cellulose and lignin are correspondingly lower in the heartwood than in the sapwood. Hardwoods may be divided into two groups, one with high extractives in the heartwood and the other with high extractives in the sapwood. In the former the cellulose content is higher in the sapwood, and in the latter in the heartwood. In both softwoods and hardwoods larger amounts of acetic acid by hydrolysis were obtained in the sapwood than in the hardwood.

**Insoluble phosphoric acid in acid phosphates and fertilizers: Some sources of error in its determination,** W. R. AUSTIN (*Indus. and Engin. Chem.*, 15 (1923), No. 10, pp. 1037, 1038).—Failure to observe certain directions in the Official method for the determination of insoluble  $P_2O_5$  in fertilizers is shown to be the cause of discrepancies in results. Among the sources of error are incomplete preliminary washing of the sample, too slow a filtration



period, and to a lesser degree the use of solutions of ammonium citrate which are not exactly neutral.

**The determination of ammoniacal nitrogen in certain nitrogenous material and particularly in proteins and the products of their decomposition,** J. FROIDEVAUX (*Compt. Rend. Acad. Sci. [Paris]*, 177 (1923), No. 21, pp. 1043-1046, fig. 1).—The method previously described (E. S. R., 48, p. 11) has been modified with a view to shortening the process as follows: The distillation is carried on in the presence of lithium carbonate at the boiling temperature instead of the cold. The liquid which distills over and is received in graduated and numbered flasks as in the original method is replaced in the distilling flask by an equal volume of distilled water, which is admitted through a graduated funnel.

**Method for the nephelometric determination of small amounts of protein,** P. RONA and H. KLEINMANN (*Biochem. Ztschr.*, 140 (1923), No. 4-6, pp. 461-477, fig. 1).—A nephelometric method for the determination of small amounts of protein is described, and data are presented on its suitability in the presence of various substances and on the limits of error in its use.

For 5 cc. of a protein solution of such strength as would be the case in a 1-50 to 1-500 dilution of human blood serum in physiological salt solution, 5 cc. of 25 per cent hydrochloric acid is added, followed by 8 cc. of a 20 per cent aqueous solution of sodium thiosalicylate with distilled water to 20 cc. With these proportions of reagents it is said that a completely homogeneous turbidity is obtained which reaches its maximum in three minutes and remains unaltered for about one hour. A Kleinmann nephelometer (E. S. R., 45, p. 412) is used for reading the turbidity.

It was found that an increase in the acidity of the precipitating medium to 20 per cent was without effect on the turbidity, and that similarly the reaction was not changed by the presence of as much as 3 cc. of saturated ammonium sulphate solution, 5 cc. of saturated magnesium sulphate solution, 6 cc. of Ringer's solution, or saturation with thymol. Protein decomposition products such as are obtained in peptic digestion had no effect up to a concentration of 60 per cent.

The limits of accuracy in this determination lie between absolute protein amounts of from 6 to 0.6 mg. in a volume of 20 cc. The mean error of the method is 0.3 per cent and the probable error 0.2 per cent.

**The quantitative determination of carotin by means of the spectrophotometer and the colorimeter,** F. M. SCHERTZ (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 9, pp. 383-400, figs. 5).—The spectrophotometric method described in the publication noted on page 714 has been applied to the determination of carotin, and the technique developed for this determination is described in detail. It was found that solutions of the same concentration of carotin in alcohol and petroleum ether gave approximately the same transmittance, while that for a corresponding solution in ether was slightly lower.

A comparison was made of the spectrophotometric method and the colorimetric method, using Lovibond slides and matching them with known solutions of carotin in a Duboscq colorimeter. The colorimeter proved unsatisfactory on account of difficulty in matching the solutions.

**Quantitative aspects of the Kreis test,** G. E. HOLM and G. R. GREENBANK (*Indus. and Engin. Chem.*, 15 (1923), No. 10, pp. 1051-1053).—Data reported from the Dairy Division, U. S. D. A., indicate that for fats the intensity of the Kreis test is proportional to the oxygen absorbed and is consequently a measure of oxidation, but that it has no direct quantitative relation to the degree of rancidity as measured by the odor of the fat, although rancid fats give the test. Some evidence was obtained that oleic acid alone is concerned



in the formation of compounds giving the Kreis tests, and that fats which do not contain this acid will not give the test.

**Notes on a method for testing the accuracy of Babcock cream and milk test bottles,** B. J. SMIT (*Analyst*, 48 (1923), No. 571, pp. 477-485).—The method described is based on the theory of the plunger method, glass rods of various lengths being used for plungers.

For cream bottles, glass rods about 7 mm. in diameter are cut in pieces from 30 to 60 mm. in length. One end of each is made to taper slightly by rounding it in the flame. The specific gravity of the glass is determined by means of a specific gravity bottle, and the rods are weighed separately and their volumes calculated. Each is then ground down on the rough end until its volume corresponds to an exact number of Babcock half per cent divisions. Twenty-two of these rods are made, varying from 2 to about 6 gm. in weight, with corresponding volumes of 1 cc. to about 2.3 cc. In use the bottle is filled to the first mark with water and four rods are selected which together will give a total reading of rather less than the total reading on the bottle. The rods are dropped into the bottle, one after another, and the reading on the bottle is taken and the volume of the rod noted. A similar procedure is used in testing the Babcock milk bottles.

**Pipette for lactose determination in milk,** E. G. MAHIN (*Indus. and Engin. Chem.*, 15 (1923), No. 9, p. 943, fig. 1).—The pipette described, which has been devised for the polariscopic determination of lactose in milk by the Official method, is graduated by intervals of 0.05 cc. from 63.5 to 64.25 cc. The volume to be measured for a milk of predetermined specific gravity is read from the table given in the Official methods, and is measured in the pipette and delivered into the volumetric flask in which the proteins are to be precipitated.

**The spectral transmissive properties of dyes.—I, Seven permitted food dyes, in the visible, ultraviolet, and near infra-red,** K. S. GIBSON, H. J. McNICHOLAS, E. P. T. TYNDALL, M. K. FREHAFFER, and W. E. MATHEWSON (*U. S. Dept. Com., Bur. Standards Sci. Paper 440* (1922), pp. 121-184, pls. 3, figs. 61).—Quantitative data on the spectral transmittancy of seven permitted food dyes are reported in the form of graphs and tables. The data were obtained by the use of four different methods, all of which are described in detail, with photographic and diagrammatic illustrations of the apparatus employed. The methods include the visual method, using the König-Martens polarization spectrophotometer; the photographic method, with the Hilger sector photometer and quartz spectrograph; the photoelectric null method; and the thermoelectric method.

**The work of the color laboratory,** J. A. AMBLER (*Indus. and Engin. Chem.*, 15 (1923), No. 9, pp. 970, 971, fig. 1).—A brief discussion is given of some of the problems now under investigation at the color laboratory of the Bureau of Chemistry, U. S. D. A. An earlier paper giving the original aims of the color laboratory and the problems first studied has been noted previously (*E. S. R.*, 43, p. 14).

**The microscopic identification and determination of the specific ingredients in stock feeds,** O. B. WINTER (*Michigan Sta. Spec. Bul. 120* (1923), pp. 3-31, figs. 9).—Part 1 of this bulletin includes a table giving the principal diagnostic characteristics, both macroscopic and microscopic, of materials commonly used in stock feeds, with references to the literature giving detailed descriptions of these materials, and a general outline for the microscopic examination of a ground mixed feed.

Part 2 contains methods and data taken in general from collaborative work done for the Association of Official Agricultural Chemists on the following problems: The adulteration of rice bran with rice hulls; the estimation of the



percentage of locust bean meal in a ground mixed feed; the estimation of the percentage of grit in a ground poultry feed; the estimation of the percentage of bone in meat scraps; the estimation of the percentage of certain ingredients in ground mixed feeds and condiments (fenugreek, linseed meal, anise); and a microscopic study of wheat bran and middlings.

Drawings and microphotographs are included, illustrating the microscopic appearance of gentian, alfalfa, quassia, velvet bean, wheat bran, linseed meal, and a mixed feed showing cottonseed meal, barley hulls, copra meal, wheat bran, linseed meal, and fenugreek.

**A colloidal method of cane juice clarification**, C. H. WELLS (*La. Planter* 71 (1923), No. 20, pp. 394, 395).—Tests on a small scale are reported of the use of hydrous colloidal aluminum silicate for the clarification of raw cane sugar.

In 10 per cent suspension in water, this colloid proved capable of coagulating the colloids of raw juice, leaving a clear sparkling juice. While clarification took place rapidly in cold solutions, the presence of other impurities coagulable by heat made it advisable to heat the mixture to boiling after the addition of the colloid. This method of clarification proved particularly satisfactory in the case of juice obtained from diseased cane.

The final tests were carried out in connection with lime treatment to reduce the natural acidity of the juice. Although a slightly longer settling period was necessary, the results obtained were equally good.

**Some simplified routine tests in sugar mill laboratories**, K. R. LINDFORS (*Indus. and Engin. Chem.*, 15 (1923), No. 10, pp. 1046-1048).—Simplified methods, such as can be performed by routine analysis with little knowledge of chemistry, are described for the determination of sugar in lime cake; the analysis of Steffen's waste and wash waters and of saccharate cake and the solution from the cooler; the determination of sucrose and raffinose in maltose, of moisture in dried pulp, and of gums in diffusion juice; and the preparation of standard acid.

**By-products of the sugar industry**, W. E. CROSS (*Rev. Indus. y Agr. Tucumán*, 13 (1922), No. 5-6, pp. 81-128).—This discussion of the utilization of various by-products of the sugar industry is presented in three chapters dealing, respectively, with the tops and leaves of the sugar cane and the bagasse, the froth or scum, and molasses. Data are included on the composition of sugar cane molasses from various sources. An appendix contains brief notes on the use of sugar cane for the manufacture of sirup and of alcohol.

**Investigation of the hypobromite method for determining bleach requirement of pulps**, T. M. ANDREWS and M. W. BRAY (*Indus. and Engin. Chem.*, 15 (1923), No. 9, pp. 934-937, fig. 1).—An investigation is reported of the applicability to various kinds of pulp of the Tingle method of determining the average requirement of pulp by the use of hypobromite solution (E. S. R., 47, p. 207).

It was found that with soda pulps there is an apparent lack of constancy in the ratio of the chlorin factor to the bleach required, and that further investigations will have to be made before this method can be applied to such pulps. With sulphite pulps, however, the method is thought to have definite value, provided the reacting solution is diluted and the temperature kept between 23 and 28° C. The modified procedure is described in detail.

## METEOROLOGY.

**The influence of climate on wheat production in Nebraska**, G. A. LOVELAND (*Bul. Amer. Met. Soc.*, 5 (1924), No. 3, pp. 43, 44).—This is an abstract of a paper on this subject presented at the Cincinnati meeting of the American

Meteorological Society, which states that during the early days of wheat growing in Nebraska it was not an important or profitable crop but was made so by the introduction of a new variety, Turkey Red, better suited to the climatic conditions; of improved cultural methods, such as the use of the press drill in seeding; and of more effective control of insect enemies, such as resulted from the establishment of seeding dates to escape Hessian fly injury. "A somewhat complete study of the weather during the critical periods in the growth of wheat in the past 25 years shows the close relation between weather and wheat production. A complete correlation of the growth of wheat during the season of 1921 and 1922 with temperature and rainfall conditions was made."

**Instructions for wiring meteorological instruments**, R. N. COVERT (*U. S. Dept. Agr., Weather Bur., Instrument Div. Circ. D, App. 2 (1923), pp. III+44, pls. 5, figs. 15*).—Instructions in conformity with modern standards, are given for the electrical installation of the instrumental equipment of Weather Bureau stations. The subjects discussed are wiring of instruments in a new building, wiring of instruments when first installed in a building already erected, re-wiring of instruments, explanation of circuits, batteries and switchboards, instructions for installing and operating the PT type storage battery, electric lights for instruments, protection against lightning, and specifications. A glossary is also included.

**Nitrogen and other substances in rain and snow**, J. H. WOHLK (*Chem. News, 127 (1923), No. 3300, p. 30*).—Examinations of rain and snow falling at Mount Vernon, Iowa, from October 1, 1922, to June 1, 1923, are reported. There were during this period 70 in. of snow and 11.2 in. of rain, equivalent to a total of 17.21 in. of rain. The total nitrogen content of the precipitation was quite constant, averaging 0.896 part per million. The average part per million of free ammonia was 0.34, of albuminoid ammonia 0.264, nitric nitrogen 0.346, nitrous nitrogen 0.397, and  $\text{SO}_3$  0.147. Chlorin varied from 3.54 to 28.1 parts per million. It is estimated that the total precipitation brought down to the soil 3.93 lbs. of nitrogen, 20.35 lbs. of chlorin, and 0.57 lb. of  $\text{SO}_3$  per acre. It is explained that the samples of rain and snow were collected under conditions which preclude excessive smoke contamination of the atmosphere.

**[Weather of 1923 in the British Isles]** (*[Gt. Brit.] Met. Off. Weekly Weather Rpt., 46 (1923), No. 52, pp. 209-212; abs. in Nature [London], 113 (1924), No. 2829, pp. 94, 95*).—Tables are given which show that the temperature was fairly normal, the highest being 95° F. in the Midland counties, the lowest 12° in eastern England and eastern Scotland. Precipitation was in excess in amount and frequency except in eastern England, the highest being 58.39 in. in north Scotland and the lowest 23.43 in. in eastern England. Bright sunshine was in fair agreement with the normal, the highest daily average being 4.7 hours in the Channel Islands.

## SOILS—FERTILIZERS.

**Recent soil researches and their application to practical agriculture**, N. K. PILLAI (*Agr. Jour. India, 18 (1923), No. 4, pp. 349-361*).—A brief review of recent advances in soil science is presented.

**Soil survey of Hardin County, Iowa**, T. H. BENTON and W. W. STRIKE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+717-757, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 364,160 acres situated a short distance northeast of the center of Iowa. The surface is a broad plain. The area lies within three distinct soil provinces. The western two-thirds is part of the



Wisconsin glacial drift plain, the northeast corner is in the older Iowan drift region, and the central-eastern and southeastern part is covered with a deposit of loess from 4 to 20 ft. thick, overlying the Kansan drift, and belongs to the southern Iowa loessial province. The Wisconsin drift area as a whole has poor drainage. In the eastern third of the county the drainage is generally from fair to good and excessive on some of the steep slopes.

The soils are prevailingly loams in texture in the drift area and silt loams in the loessial region. They are mostly dark brown to black in color and contain a high percentage of organic matter. Including peat and muck, 26 soil types of 17 series are mapped, of which the Carrington and Clarion loams, Tama silt loam, and Webster silty clay loam cover 35.2, 19.5, 13.2, and 10 per cent of the area, respectively.

**Soil survey of Tyrrell County, N. C.,** W. B. COBB and W. A. DAVIS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+839-858, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture and Experiment Station, deals with the soils of an area of 249,600 acres in northeastern North Carolina, lying entirely within the lowest and most eastern of the marine terraces making up the Coastal Plain region. The topography is generally flat, but contains numerous ridges elevated only a few feet above the surrounding country. Except for the higher of these ridges the drainage of the country is poor.

The soils are derived from unconsolidated sands and clays of sedimentary origin. Including peat and muck, 16 soil types of 7 series are mapped, of which peat and Portsmouth loam cover 46.1 and 17.4 per cent of the area, respectively.

**Preliminary soil survey of southwestern Ontario,** R. HARCOURT, W. L. IVESON, and C. A. CLINE (*Ontario Dept. Agr. Bul. 298 (1923), pp. 35, pl. 1, figs. 6*).—This bulletin reports the results of a general physical survey of an area in the Province of Ontario lying west of Kingston on the Albermarle-Amabel town line. The area includes poorly drained, flat to gently undulating sections, gently rolling to hilly sections, sections that are hilly to very steep and broken, and very steep and broken sections. The soils are mainly of glacial origin. Including muck and peat, 23 soil types of 9 series have been recognized.

**Studies of an acid soil in Assam, II,** A. A. MEGGITT (*India Dept. Agr. Mem., Chem. Ser., 7 (1923), No. 2, pp. 31-53, pl. 1, figs. 5*).—In a second contribution to the subject (*E. S. R., 32, p. 812*), studies are reported which showed that very great losses of soil nitrogen may take place in a humid and hot climate with a heavy rainfall during about half of the year. This rate of loss is much increased by liming, and bare fallows in the rainy season are especially wasteful. On the other hand, when cropped, the increase in vegetation due to liming tends to conserve the nitrogen. It is considered probable that the losses are incurred chiefly by the leaching of nitrates in drainage waters.

With reference to nitrogen fixation, it appeared absolutely essential that the soil be limed. The periodical use of phosphoric acid also seemed to be helpful. Sugar was preëminent as a source of energy for the fixing bacteria, but was out of the question for field use. Although cellulose decomposition products may serve as a necessary source of energy, the use of straw was found to cause no fixation.

Soil work at different districts in Assam showed that on opening cultivable waste lands a more or less rapid fall of nitrogen initially must be expected. The only practical solution of the problem appeared to be the adoption of a sound rotation embodying green manuring, with the periodical use of lime and phosphate.

**A soil acidity map of a Long Island wild garden,** E. T. WHERRY (*Ecology, 4 (1923), No. 4, pp. 395-401, fig. 1*).—It is stated that in regions where soil



acidity is irregular and not readily ascertainable from the surroundings, numerous tests and a map showing areas of different degrees of acidity are desirable. On this basis a map is presented of a tract of 100 acres on the terminal moraine on the north side of Long Island, on which acidity is indicated by lines resembling contours.

The data indicate that the reaction of the extracts from these particular soils was not changed by standing in contact with the soil for a day, but that the acidity was markedly reduced by filtration. The highest acidities were found on the ridges, and the decrease in descending the slopes was more rapid on the south than on the north side. The ridge soils showed a gradual decrease in acidity with depth of from pH 4.5 to pH 6. The acidity of the surface soil was due to very weak, slightly ionized acids, while that of the subsoil was due to more considerably ionized acid substances. The water of springs on emerging had a specific acidity of 10, which decreased rapidly to 3. A small artificial pond had a specific alkalinity of 30, corresponding to pH 8.5.

**Effect of drying and storage upon the H-ion concentration of soil samples,** C. O. ROST and E. A. FIEGER (*Soil Sci.*, 16 (1923), No. 2, pp. 121-126).—Studies conducted at the University of Minnesota on the effect of air and oven-drying, of moistening and tempering of samples of soil which had become air-dry, and of storing the fresh moisture samples in air-tight containers upon the H-ion concentration of soil samples are reported. The effect of air-drying upon soil reaction was also tested.

Soil samples from five fields upon which liming experiments are in progress showed differences in pH values between the fresh and air-dry samples of from 0.03 to 1.17. The acid samples showed as great a change upon air-drying as did the alkaline ones, some samples becoming more acid and some more alkaline upon air-drying. The general tendency, however, was to become more acid, as indicated by tests of 144 glacial and loessial soils. With the glacial subsoils, the difference between the fresh and air-dry samples tended to increase as the pH increased. The loess subsoil did not show this tendency, and the glacial soils in general showed a more marked change in the air-drying than the loess.

Air-drying of soil samples in most cases increased the intensity of the reaction obtained by the qualitative potassium thiocyanate method. Oven-drying rendered all soil samples tested more acid than they were in the fresh condition. Of 21 samples tested, all except 4 were more acid than when in the air-dry condition. Samples air-dried, then moistened with distilled water and tempered, were more acid than the same soils in fresh condition. Of the 7 samples tried, all but 1 were more acid than when in the air-dry condition.

The H-ion concentration of fresh moist soils stored for three months in air-tight glass containers changed in most cases, some samples becoming more acid and some less so, but with a general tendency to become more acid. The amount of change was not related to the degree of acidity or alkalinity. It is concluded that the only reliable indication of conditions existing in the field is obtained when H-ion concentration determinations are made with fresh soil samples.

**Note on soil denudation by rainfall and drainage: Conservation of soil moisture,** G. D. HOPE (*Trop. Agr. [Ceylon]*, 61 (1923), No. 3, pp. 149-153, pls. 4).—Methods of preventing soil erosion as practiced in India and the Dutch East Indies are described and illustrated.

**Medium soil temperatures,** F. EREDIA (*Met. Prat. [Osserr. Montecassino, Italy]*, 2 (1921), No. 2, pp. 41-48, fig. 1).—The author reviews work by himself and others bearing on the subject, and reports studies of monthly and average



annual temperatures of Italian soils at depths of 20, 40, and 60 cm. and at 25 meters in the air above.

The results showed that the average annual temperature of the soil increased with the depth from 18.2° C. at 20 cm. depth to 19° at 60 cm. depth, while the average annual temperature of the air was 17.6°. The annual variation in temperature was 17.9° at 20 cm., 17.5° at 40 cm., and 16.9° at 60 cm. depth, while that of the air was 16°. There was an increase in soil temperature at all depths from winter to summer and a decrease from summer to winter. The greatest seasonal variation was the increase in temperature at all depths between spring and summer. The greatest decrease was between fall and winter.

Studies of the maximum and minimum monthly temperatures of the soil at all three depths and of the difference between these two showed that this difference was usually greater than 2° except in the months of January, February, March, June, and July. The greatest difference occurred in April at all three depths. In most months, except November and December, the differences between the maximum and minimum temperatures decreased as the depth in the soil increased. It is also noted that the greatest differences next to that in April occurred at all depths in the months of September, October, November, and December.

Studies of the difference between air and soil temperatures at a depth of 60 cm. on 31 different days and at 22 different localities in Italy and its colonies showed that the daily and hourly variations of this difference were quite large.

These results are taken to indicate that temperature variations in Italian soils are dependent quite largely upon the different meteorological factors, especially rainfall.

**Soil ventilation as an ecological factor**, L.-G. ROMELL (*Meddel. Statens Skogsförsöksanst., No. 19 (1922), pp. 125-359, figs. 11; abs. Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 13 (1922), No. 12, pp. 1435, 1436*).—Studies on the influence of increasing the deficiency of oxygen and the excess of carbon dioxide in soil caused by decreased gaseous exchange between the soil and the air as ecological factors are reported.

Investigations of the oxygen and carbon dioxide economy of the biologically important soil strata showed that normally a very brisk gaseous exchange takes place between these strata and the atmosphere. The amount of carbon dioxide escaping in 1 hour corresponded to the entire amount contained in the soil to a depth of 20 cm. (7.9 in.). This is taken to indicate that the amount of carbon dioxide liberated is equal to that produced. On the other hand, biological activity was most intense near the surface, 68 per cent of the carbon dioxide being produced at a depth of less than 20 cm., indicating that a superficial layer will normally contain all the carbon dioxide that is produced therein in about 1.5 hours. Thus an interruption in the gaseous exchange lasting only 0.5 hour would suffice to double the excess of carbon dioxide. It is concluded that normal gas exchange should be governed chiefly by factors of equal intensity when considered collectively.

Studies of the mechanism of gaseous exchange in soils showed that diffusion is the chief agent in the aeration of ordinary soils and the exclusive agent in the aeration of forested soils. Aeration and the relation between oxygen and carbon-dioxide content were found to depend in the first instance upon the intensity of the distribution of bacterial activity in the soil, and the air-filled pore space. The total amount of air present in the superficial strata of soil was of primary importance. The excess of carbon dioxide and the deficiency of oxygen in soil were directly proportional to bacterial activity, and were lower in a soil where bacterial activity was most concentrated in the superficial strata.



When the intensity and distribution of bacterial activity were uniform, the excess of carbon dioxid and the deficiency of oxygen were inversely proportional to the air content of the soil.

The size of soil particles was of secondary importance, provided their dimension was not below a minimum value. A stratum of stiff clay gradually decreased the aeration, sometimes to  $\frac{1}{100}$  of its normal value. Stopping the soil pores with water reduced the air present to  $\frac{1}{10.000}$  of its normal amount. The bacterial activity and air content of the superficial strata also influenced the excess of carbon dioxid and deficiency of oxygen of lower strata. A partial blocking of the pores or an increase in the bacterial activity in a surface stratum was sufficient to raise the excess carbon dioxid and deficiency of oxygen values of all of the lower strata.

Studies of the ecological importance of carbon dioxid excess and oxygen deficiency in soils indicated that the tolerance exhibited by plants to these conditions is quite variable. Complete or almost complete cessation of gaseous exchange, even though only lasting a short time, was extremely injurious to plants of low resistance owing to the fact that the absorption of water by the roots was made a very difficult process. This is taken to indicate that under certain conditions aeration may become an important ecological factor.

It is further concluded that all cases of injury due to insufficient aeration occur in soils containing an excess of humidity or an excess of clay, with the exception of soils containing much humus. Experiments showed that a superficial layer of humus does not hinder good aeration, and that drainage is the only method providing the roots of plants on forest soils with a larger supply of oxygen.

A large amount of tabular data descriptive of the numerous types of Swedish soils is included.

**The bacteriology of agricultural soil and its difficulties and fallacies,** G. ROSSI (*Internatl. Rev. Sci. and Pract. Agr.* [Rome], n. ser., 1 (1923), No. 1, pp. 13-24, pls. 3).—In a contribution from the Royal Higher School of Agriculture, Portici, Italy, difficulties and fallacies in soil bacteriological studies are briefly discussed. It is concluded that methods of research in connection with fertile soils should be standardized, and that the local schizomycete flora should be studied.

**Bacteria which decompose nucleoproteids and their importance for setting free the phosphorus supplies in agricultural soil,** A. KOCH and A. OELSNER (*Biochem. Ztschr.*, 134 (1922), No. 1-4, pp. 76-96).—Studies conducted at the University of Göttingen are reported, the results of which showed that the nucleoproteid phosphorus occurring in organic compounds in the soil is subject to rapid decomposition through the activity of different soil bacteria, especially the so-called nucleobacter, resulting in the production of inorganic phosphates. A part of such phosphates is made available as plant nutrient material, and another part is absorbed by the bacteria themselves. After the death of the bacteria, their phosphatic content becomes available to plants in inorganic compounds.

In addition to the action of bacteria, the presence of lime in soil was also found to have an important influence on the decomposition of nuclein. It was found that lime caused a decomposition of nuclein to nucleic acid and eventually to inorganic phosphoric acid. The presence of lime also favored the activity of the bacteria which decompose nuclein.

Methods for the analysis of organic phosphorus compounds are briefly described.

**Activity of biological phenomena in peat,** A. DEMOLON and P. BOISCHOT (*Compt. Rend. Acad. Sci.* [Paris], 177 (1923), No. 4, pp. 282-284).—Studies are



reported which showed that the passive biological nature of peat is due mainly to its poverty in available nutrient elements, especially phosphoric acid. It is concluded that the results obtained in the partial sterilization of peat by heat are not due to the destruction of toxins or protozoa, but are due rather to a favorable chemical modification of the peat.

**The nitrogen of animal excrement, its conservation, and its value as a plant nutrient**, F. HONCAMP (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 5, Wiss., pp. 299-319).—A summary of the results of a number of studies from different sources on the conservation and use of liquid manure nitrogen is presented.

**Explanation of the fertilizer action of organic substances**, A. GEHRING (*Centbl. Bakt. [etc.]*, 2. Abt., 57 (1922), No. 11-13, pp. 241-271).—A series of studies on the influence of organic matter in soil on its productivity are reported.

The results of a study of carbon dioxid production in soil indicated that the carbon dioxid produced and the increase of this production by the use of organic fertilizers may exercise a marked influence on crop yields.

Further studies to determine whether the amount of easily decomposable humus in a soil is an accurate indication of the nature of the biological processes taking place therein showed that in only one instance was there a clearly evident connection between the bacterial activity of a soil and its content of easily decomposable organic matter.

In final studies to determine under what circumstances a relation exists between the variations in the physical properties of a soil and the nature of its humus constituents, fallowing produced only a very small and practically negligible improvement of the physical condition of soil, while clover and stable manure produced almost identical changes. These results are taken to indicate a marked dependence of the physical properties of the soil upon its carbon dioxid production.

**The influence of koufri, marog, and tafla on the biological phenomena of soil**, V. M. MOSSÉRI (*Bul. Union Agr. Égypte*, 21 (1923), No. 151, pp. 139-155).—In a further contribution to the subject (*E. S. R.*, 48, p. 819), studies are reported on the influence of koufri on nitrification in soil and in artificial cultures.

The results showed that the organic matter contained in koufri is not capable of nitrification within itself, since this material is not only an improper medium for nitrification and ammonification but acts as a deterrent to these processes, in that it provokes a marked escape of the nitrogen of organic or ammoniacal substances introduced into it. While ammonium sulphate and dried blood were almost completely nitrified in arable soil, their nitrification did not take place in koufri, and a considerable loss in nitrogen resulted. The same thing occurred when dried blood together with koufri was incorporated in the soil. However, when koufri was added to the soil in a manner similar to actual fertilization practice, an increase in the quantity of nitric nitrogen was noted, which was due to the nitrification of the organic matter of the koufri and varied in amount accordingly from 10 to 25 per cent.

The nitrogen of dried blood was found to be from 3.75 to 7.5 times as available as that of koufri. The average of 29 analyses of koufri from the neighborhood of Cairo showed a content of organic nitrogen of 0.38 per cent. The average of 30 analyses of koufri from lower Egypt showed an organic nitrogen content of only 0.14 per cent. Tafla was found to contain almost no organic nitrogen, while marog contained only from 0.02 to 0.03 per cent.

**Accomplishments in research on nitrogen fixation** (*Chem. and Metall. Engin.*, 29 (1923), No. 24, pp. 1047-1050, fig. 1).—In a contribution from the



U. S. D. A. Fixed Nitrogen Research Laboratory, the status of various nitrogen fixation processes is discussed.

**Experiments on the arc process for nitrogen fixation**, E. D. McCOLLUM and F. DANIELS (*Indus. and Engin. Chem.*, 15 (1923), No. 11, pp. 1173-1175, figs. 2).—Studies conducted at the University of Wisconsin are reported, which showed that liquid nitrogen peroxid may be made on a laboratory scale from air in an electric arc with the help of silica gel. No improvement in the chemical efficiency of the arc was obtained by using rapid air currents, by interrupting the arc, or by changing the character of the arc with condensers. Better yields were obtained at high voltages.

**Nitrates and ammonia from atmospheric nitrogen, I-III**, E. K. SCOTT (*Jour. Roy. Soc. Arts*, 71 (1923), Nos. 3702, pp. 859-876, figs. 10; 3703, pp. 877-895, figs. 8; 3704, pp. 900-917, figs. 7).—The first contribution to this subject summarizes a large amount of statistical data on the securing of nitrates and ammonia from atmospheric nitrogen, the second contribution deals with the financial phases of the subject, and the third with synthesis of ammonia.

**The absorption of ammonium ions out of solutions of different ammonium salts and the action of electrolytes thereon**, B. AARNIO (*Ztschr. Pflanzenernähr. u. Düngung*, 1 (1922), No. 5, Wiss., pp. 320-325).—Studies on the absorption of ammonia from N/10 solutions of ammonium chlorid, ammonium sulphate, and ammonium phosphate by different soils are reported.

The results showed that the amounts of ammonia absorbed from ammonium chlorid and ammonium sulphate solutions were about the same, while the amounts absorbed from ammonium phosphate solutions were much greater.

Studies on the influence of electrolytes on ammonia absorption showed that H-ions depressed the absorption and OH-ions increased it.

**The volatilization of the ammonia of ammonium sulphate and soil reaction**, J. A. PRESCOTT (*Bul. Union Agr. Égypte*, 21 (1923), No. 151, pp. 121-128, fig. 1).—Field experiments with maize and laboratory studies are reported which showed that the lower efficiency of ammonium sulphate on alkaline soils as compared with that of sodium nitrate is due principally to the liberation of ammonia from the ammonium sulphate when in contact with the soil. The rate of which such liberation takes place was found to be a function of the aeration and reaction of the soil.

**Remarks on the note of Prescott relative to the volatilization of the ammonia of ammonium sulphate and soil reaction**, V. M. MOSSÉRI (*Bul. Union Agr. Égypte*, 21 (1923), No. 151, pp. 129-138).—This is a brief discussion of the above report in which some of its practical phases are emphasized.

**Studies on nitrification and H-ion concentration**, T. GAARDER and O. HAGEM (*Bergens Mus. Aarbok, Naturv. Raekke*, 1919-20, No. 1, Art. 6, pp. 1-31, figs. 3).—Studies are reported which showed that nitrification in soil bears a fixed relation to H-ion concentration, that the optimum H-ion concentration for nitrate formation is at the approximately neutral point corresponding to pH 7, and that the optimum H-ion concentration for nitrite formation is at a reaction corresponding about to pH 7.8. Attention is drawn to the fact that these results so far are valid only for the specific conditions of the experiments. Further studies are in progress to determine the extent of their applicability.

**A preliminary note on the decomposition of calcium cyanamid in south Indian soils**, R. V. NORRIS, B. VISWANATH, and C. V. RAMASWAMI AYYAR (*India Dept. Agr. Mem., Chem. Ser.*, 7 (1923), No. 3, pp. 55-75, pl. 1, figs. 2).—Laboratory and field studies on the use of calcium cyanamid in the soils of south India are reported.

The results showed that calcium cyanamid, when added to these soils in ordinary agricultural applications, is not harmful to crops. No lapse of time



was found necessary between the application of fertilizer and planting. Calcium cyanamid rapidly decomposed into urea in this soil, the change being chemical or physico-chemical in nature. The hydrolysis of the urea to ammonia and its subsequent oxidation to nitrates was a biochemical process.

Dicyandiamid was not produced in the soil from calcium cyanamid when it was applied in normal amounts and thoroughly incorporated in the soil. It could be produced, however, when high concentrations of cyanamid were used. Dicyandiamid was found to decompose very slowly in the soil. It did not affect germination, but inhibited nitrification. The latter was more pronounced in the case of ammonium sulphate than in the case of organic nitrogenous substances, such as peanut cake.

**Phosphate behavior in soils**, J. S. BURD and J. C. MARTIN (*Science*, 58 (1923), No. 1499, pp. 227, 228).—In a contribution from the University of California, studies are briefly summarized which indicated that the generally recognized diminished total concentration in the soil solution may be accompanied by an enhanced, or a tendency toward an enhanced, concentration of phosphate. The apparent result of this effect was observed in two soils cropped to barley, in which solutions displaced at the end of the season had very much higher concentrations of phosphate and lower concentrations of other electrolytes than did the solutions displaced at the beginning of the season.

**The comparative availabilities of different phosphatic fertilizers**, A. DEMOLON (*Ann. Sci. Agron. Franç. et Étrangère*, 40 (1923), No. 3, pp. 151-169, fig. 1).—Studies of the solubility of different phosphatic fertilizers in water saturated with carbon dioxide are reported.

The results were found to correspond satisfactorily with those obtained in cultural experiments. They indicated the superiority of superphosphate in calcareous soils and of precipitated phosphates in noncalcareous silty soils. The phosphoric acid contents of basic slag and of bone phosphate showed equal rates of availability. The lower availability of the phosphoric acid of reverted superphosphate was found to be due mainly to iron salts. Solubility in water saturated with carbon dioxide is not considered sufficient to explain the fertilizing action of iron phosphate, and the influence of humus materials in this connection is discussed.

**Basic slag as phosphate fertilizer**, W. H. WAGGAMANN and H. W. EASTERWOOD (*Chem. and Metall. Engin.*, 29 (1923), No. 20, pp. 873-876, figs. 3).—In a contribution from the U. S. D. A. Bureau of Soils, a brief history is given of the development of the use of basic slag as a phosphatic fertilizer, and particular attention is drawn to the attempts made to improve the basic slag obtained from the more recent basic open-hearth processes. Some of the schemes proposed to meet the changing conditions in the manufacture of steel, without sacrificing the availability of the basic slag, are briefly reviewed.

The belief seems general that the most practical means of obtaining a highly phosphatic slag when manufacturing steel by the basic open-hearth method is to use a duplex process. In the Bertrand-Thiel process two furnaces are used, in the first of which pig iron without scrap is smelted with basic material. Practically all of the phosphorus and silicon are removed from the metal in this primary furnace, and a highly phosphatic slag is obtained. The metal is then transferred to a secondary furnace containing limestone, scrap, and fluorspar, and the refining of the steel is thus completed.

The American duplex method is almost the reverse of the Bertrand-Thiel process, since the metal is first desiliconized in an acid Bessemer converter,

the acid slag tapped off, and the metal then placed in a basic open-hearth furnace in order to remove the phosphorus.

**Potash**, P. KRISCHE (*Das Kali. Stuttgart: Ferdinand Enke, 1923, vol. 1, pp. XII+382, figs. 22*).—This book is one of the Enke Library of Chemistry and Technique series, edited by L. Vanino. It is the first of two volumes, and deals with the history of potash salts, the development of the potash industry, especially in Europe, and the distribution of potash in nature.

**Report on Texas alkali lakes**, C. C. MEIGS, H. P. BASSETT, and B. G. SLAUGHTER (*Tex. Univ. Bul. 2234 (1922), pp. 60, pls. 9, figs. 9*).—This report presents the results of an investigation of the alkali lakes of west Texas, largely from the standpoint of their commercial development as sources of salt, magnesia, and potash, and includes estimates on plant and cash requirements, cost of production, and profits, as well as the probable price of foreign potash. The University of Texas assumes no responsibility or obligation as to the accuracy of these estimates.

**Potash and magnesia fertilization**, E. A. MITSCHERLICH, H. WAGNER, F. DÜHRING, S. VON SAUCKEN, and C. BÖHM (*Landw. Jahrb., 58 (1923), No. 5, pp. 645-653*).—Studies are reported on the fertilizing effect of increasing potash and magnesia fertilization on the yield of oats.

The results showed that the fertilizing action of potassium was tripled in the presence of sodium, while with magnesia increases in yield were produced only in exceptional cases. Magnesia fertilization had no other incidental influences on the yield.

**Lime in 1922**, G. F. LOUGHLIN and A. T. COONS (*U. S. Geol. Survey, Min. Resources U. S., 1922, pt. 2, pp. 195-206*).—Data on the production, sale, and use of different forms of lime in the United States during 1922 are summarized.

It is noted that there was an increase of 44 per cent in the quantity of lime produced in 1922 over that of 1921. On the other hand, the total sales of lime for agricultural purposes decreased 4 per cent in quantity in 1922, Ohio being the only important State to show an increase. Pennsylvania, the principal producing State, showed a 10 per cent decrease. The production of ground limestone was also 9 per cent less in 1922 than in 1921. Sales of calcareous marl, oyster-shell lime, and hydrated lime for agricultural purposes increased 13, 29, and 5 per cent in quantity, respectively, in 1922.

**Investigations on the lime requirements of soils**, H. R. CHRISTENSEN (*Ztschr. Pflanzenernähr. u. Düngung, 1 (1922), No. 5, Wiss., pp. 265-290*).—The author summarizes the results of studies by himself and others which indicate that the lime requirement of Danish soils is closely related to the growth of *Azotobacter* therein, and that it is an indication of a special soil condition produced by the presence or absence of proper buffer substances. It is shown that a strong *Azotobacter* growth in a soil is an indication of a good supply of lime, while a weak *Azotobacter* growth or no growth indicates a lime requirement or a potential lime requirement.

Data from the results of studies of a number of Danish soils are tabulated.

**Sulphur in relation to soil fertility**, W. L. POWERS (*Oregon Sta. Bul. 199 (1923), pp. 5-45, figs. 17*).—This is a statement of the progress of studies on sulphur in relation to soil fertility conducted by the station, and supplements previous reports on the subject (*E. S. R.*, 42, p. 221; 43, p. 21).

The more recent results have shown that legumes, particularly alfalfa and red and alsike clovers, respond markedly to sulphur fertilizers. Moderate increases were obtained on wheat and potatoes and but little increases on field peas, beans, corn, kale, rape, or sunflowers. The benefit to potatoes is attributed largely to its indirect action in controlling potato scab and to some increase in ammonification.



Numerous recent analyses and four fertility field experiments showed that the soils of the extensive red hill regions extending from Coos Bay to Astoria and from the Pacific to the Cascades, covering the coast hills and the hills surrounding the Willamette Valley, contain only from 150 to 400 lbs. of sulphur in the plowed surface of an acre and yield from 25 to 50 per cent more clover and grain when treated with sulphur. Elemental sulphur was found to be the most economical form, costing about one-third that secured in gypsum. Water culture, pot culture, and tank experiments indicated that sulphur is an especially critical element, but that only a small amount is necessary. Yields were markedly increased and water requirements strikingly decreased by adding a little sulphur at the point of its elimination or near elimination. Use of amounts in excess of that needed to meet the absolute deficiency has tended to aggravate soil acidity in humid and semihumid sections of southern and western Oregon.

Lysimeter studies showed that from 40 to 45 lbs. of sulphur per acre are lost from the soil annually by percolation, while only from 3 to 6 lbs. are received in precipitation. Laboratory experiments indicated strongly that a little gypsum or sulphur and lime aids nitrification at the beginning of the growing season. Sulphur oxidation studies showed that most of the Oregon soil types contain organisms capable of oxidizing sulphur more rapidly than is necessary for plant needs.

Field experiments in the State with sulphur as a fertilizer have shown that applications amounting to 1,000 lbs. per acre during a 10-year period have resulted in a continued marked increase in yield. The duration of the increase in yield from a 100-lb. application has been found to be from 3 to 5 years, the heavier soil types retaining the sulphur longer. A combination of sulphur, rock phosphate, manure, and lime has given maximum yields in some recent field experiments.

**Sulfonation in pure and mixed cultures, with special reference to sulphate production, H-ion concentration, and nitrification, H. D. BROWN** (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 9, pp. 350-382, pls. 2).—Studies conducted at Cornell University on the factors which control sulphur oxidation and on the effects of sulphur treatments on soils are reported.

Pure cultures of a sulphur-oxidizing organism, isolated from soil and activated sludge and resembling *Thiobacillus thiooxidans* in cultural characteristics and morphology, were maintained in liquid culture, and a solid medium was developed which gave satisfactory growth. In numerous tests the organism showed strong sulphur-oxidizing power and greatly increased the H-ion concentration of the medium. The initial pH of the medium and the area of surface exposed altered the amounts of sulphur oxidized in any given period. Bacteriological studies showed that the organism was of the *Pseudomonas* type, having a single polar flagellum.

Studies on the effect of sulphur oxidation on the nitrogen of a soil during a period of 20 weeks under optimum cultural conditions showed that no nitrogen was lost from a limed soil under sulphur treatments as high as 2,000 lbs. per acre. Large amounts of sulphur were oxidized, and the H-ion concentration of the soil extract was increased.

Quartz and soil media showed some nonbiological oxidation of sulphur during a 50-day period. In both media over 100 mg. of sulphur were oxidized per 1,000 gm. of medium. Additions of calcium carbonate stimulated sulphur oxidation in the soil, and additions of calcium carbonate and iron stimulated it in the quartz media. The amount of sulphur oxidized nonbiologically was a small part of that oxidized in an ordinary soil. There was no indication of nonbiological nitrification.



A pressure of 20 lbs. per square inch for 50 days slightly increased sulphur oxidation except when calcium carbonate had been added. The stimulation to nitrification was so slight as to be insignificant. A pressure of 50 lbs. per square inch for 50 days markedly depressed sulphur oxidation and nitrification under all treatments used. Liquid cultures of the sulphur-oxidizing organism were less active under both pressures than under atmospheric conditions. The treatments of sulphur, calcium carbonate, and ammonium hydroxid had more effect upon sulphur oxidation and nitrification than had the pressures. Calcium carbonate greatly stimulated sulphur oxidation and nitrification, while sulphur treatments depressed the latter.

Analyses of greenhouse soils, under cropped and uncropped conditions, showed the interrelation of sulphur oxidation, H-ion concentration, and nitrification. As sulphur was oxidized, the H-ion concentration increased regularly and nitrification was depressed. Liming stimulated both sulphur oxidation and nitrification and decreased the H-ion concentration for a time. Applications of 3 tons of calcium carbonate per acre did not entirely alleviate the depressing effect of 2,000 lbs. of sulphur per acre on nitrification.

Crop growth was materially retarded and stunted by sulphur treatments of more than 1,000 lbs. per acre. On unlimed soils this effect was very noticeable with 500 lbs. of sulphur per acre. With liming, all barley plants matured and produced good grain, although some were from two to three weeks late in maturing. Without lime, no sound grain was produced when the sulphur treatment was 500 lbs. per acre or more.

**The biochemical sulphur oxidation as a means of improving alkali soils,** J. S. JOFFE and H. C. McLEAN (*Science*, 58 (1923), No. 1490, pp. 53, 54).—Studies conducted at the New Jersey Experiment Stations on the improvement of alkali soils through the oxidation of sulphur are briefly reported.

The results showed that sulphur oxidized rapidly in alkali soils from the California Experiment Station in the early period of incubation. The acid produced coagulated the colloids, destroying the impermeability of the soils, and thus permitted leaching operations. These results are taken to indicate the possibility of bringing black alkali soils of the most hopeless character back to productivity by treating with sulphur and then leaching.

**Manganese, aluminum, and iron ratio as related to soil toxicity,** R. H. CARR and P. H. BREWER (*Indus. and Engin. Chem.*, 15 (1923), No. 6, pp. 634-637, fig. 1).—Experiments conducted at the Indiana Experiment Station on soil acidity are reported.

The soluble manganese, aluminum, and iron present in toxic quantities in many soils were found to be quite soluble in a 5 per cent solution of potassium thiocyanate. Aluminum, ferric and ferrous iron, manganese, calcium bicarbonate, and magnesium were found to precipitate as hydroxids in the order named, and ranged in reaction from pH 4 to pH 10. It is thought that different amounts of limestone added to the soil will precipitate some of these elements in the same order, depending upon the amounts added and the pH attained.

But little indication of manganese toxicity was evident when from 0.006 to 0.008 per cent of manganese was present in soil, but from 0.015 to 0.03 per cent caused a very pronounced toxicity. When considerable manganese was found in a soil in soluble form it required from 40 to 50 cc. of N/10 base per 50 gm. of soil to precipitate the manganese as hydroxid. This is equivalent to from 4 to 5 tons of limestone per acre. The addition of this amount is considered very expensive, and in some instances would cost more than the original price of the land.

**Effect of sulphur, calcium, and phosphorus on the yield and composition of alfalfa on six types of Idaho soils,** R. E. NEIDIG, G. R. McDOLLE, and



H. P. MAGNUSON (*Soil Sci.*, 16 (1923), No. 2, pp. 127-136).—Studies conducted at the Idaho Experiment Station on the effect of additions of lime, sulphur, gypsum, and phosphorus on the yield of alfalfa, on the nitrogen and sulphur content of the crop, and on the soluble potash in the water extract of six Idaho soils are reported. Four of the soils were from the humid portion of the State and two from the arid portion.

Sulphur in some form distinctly increased the yield of alfalfa on the soils from the nonirrigated part of the State, but had no marked effect upon the yield of alfalfa on arid soils. Sulphur in all forms increased the total nitrogen removed by the alfalfa from the soil and the percentage of sulphur in the plant.

Different forms of sulphur produced varied effects on the yield and composition of the crop on each soil. Phosphorus increased the yield of alfalfa on all but two of the soils, the arid soils responding more markedly to applications of phosphorus and less to sulphur than humid soils. All applications of phosphorus increased the percentage of sulphur in the alfalfa and slightly increased the nitrogen content of the alfalfa from all but two of the soils. The effect of these treatments on soluble potash was variable, depending upon the soil type.

**Mineral resources of the United States in 1922.**—Preliminary summary, compiled by M. B. CLARK (*U. S. Geol. Survey, Min. Resources U. S., Prelim. Summary, 1922, pp. IV+124A*).—This is the fifth annual preliminary summary of the mineral production of the country and contains, among other things, sections on clay, gypsum, lime, magnesium, marl, peat, phosphate rock, and potash.

## AGRICULTURAL BOTANY.

**Botany of the living plant**, F. O. BOWER (*London: Macmillan & Co., Ltd., 1923, 2. ed., pp. XII+634, figs. 484*).—The attempt has been made to embody in the present volume various improvements (indicated in the preface, largely as related to the present views on evolutionary history) to the first edition previously noted (*E. S. R.*, 44, p. 130).

**The Cucurbitaceae, I, II**, A. ZIMMERMANN (*Die Cucurbitaceen, I, II. Jena: Gustav Fischer, 1922, pts. 1, pp. VIII+205, figs. 95; 2, pp. IV+186, figs. 99*).—Of these contributions on the Cucurbitaceae the first part deals with anatomy and physiology and the second with anatomy, morphology, biology, pathology, and classification.

**Higher fungi of the Hawaiian Islands**, E. A. BURT (*Ann. Missouri Bot. Gard.*, 10 (1923), No. 2, pp. 179-189).—The fungi enumerated in the present list consist of Basidiomycetes collected by F. L. Stevens in the Hawaiian Islands during the summer of 1921, and of the fungi in the Bernice Pauahi Bishop Museum Herbarium which were brought to the United States for study in connection with the Stevens collections. Most of the specimens from the museum were collected by C. N. Forbes. The 150 numbers which comprise this lot of specimens belong to 61 species. The purely North American component in the higher fungal flora of the Hawaiian Islands is hardly a fourth as great as that from Asiatic, East Indian, and Philippine sources, so far as the present small number of species show. The descriptions and notes are based on characters retained by the dried specimens.

**The North American slime molds**, T. H. MACBRIDE (*New York and London: Macmillan Co., 1922, [2] ed., rev., pp. XVII+347, pls. 24*).—This book, containing a descriptive list intended to include all species of Myxomycetes hitherto reported for the Continent of North America, with notes on some extralimital species, is a second edition, the first having appeared in 1899.

**Mold fungi in sugar inversion**, W. L. OWEN (*Facts About Sugar*, 16 (1923), Nos. 25, pp. 519-521; 26, pp. 546-548).—"A study of the comparative inverting power of 17 species of mold fungi and extracts made therefrom shows that the comparative rank of these molds, with their extracts, as based upon their inverting power, is practically the same.

"Of all the species studied *Aspergillus repens* showed by far the greatest inverting power. The extracts from some of these species were found to be capable of inverting sucrose at densities at which the mold from which the extract was made was inactive. This suggests the possibility of sugar deterioration taking place in some instances independently of the immediate activity of microorganisms.

"More active extracts could be obtained from young than from old cultures, and no advantage was found in allowing the molds to autolyze before extracting them.

"The autolysis of the mold tends to make the inverting strength of the porcelain filtrate more nearly equal with that of the unfiltered extract than is usually true of the filtered and unfiltered unautolyzed extracts."

**Studies upon the life cycles of the bacteria.—I, Review of the literature, 1838-1918**, F. LÖHNIS (*Mem. Nat. Acad. Sci.*, 16 (1922), No. 2, pp. 335, figs. 387).—This is an extensive review, mainly bibliographical, of the subject previously dealt with from the experimental side (*E. S. R.*, 49, p. 221).

**A new feature in vascular anatomy as displayed by bamboo, particularly by the young sheath leaf**, W. M. PORTERFIELD (*China Jour. Sci. and Arts*, 1 (1923), No. 3, pp. 273-279, pls. 2).—Young shoots of *Phyllostachys nidularia* showed the growing point to be inclosed by an envelope of closely packed, 2-ranked sheathing leaves which are protective and which later for a time function as synthetic organs. The young sheaths showed advanced vascular development. The bundles are of the collateral type and in the annular tracheae display transverse bars. These bars are separate but may be branched, are mostly three to five in number, are parallel in a plane which is at right angles to the axis of the vessel, and are always placed radially with respect to the shoot which lies in the center. Their function is stated as entirely mechanical. They furnish additional support and protection against the binding of the older sheaths on the outside and the expanding growing point on the inside. Together they form a plate comparable to a gridiron on account of which the author recommends the term "craticulae." Bars of this character seem to be new in histological writings.

**Geniculate spikes in wheat**, E. MANCINI (*Coltivatore*, 68 (1922), Nos. 32, pp. 438-442, figs. 5; 34, pp. 516-519, fig. 1; 35, pp. 555-559; 36, pp. 587-591, figs. 3).—Geniculation in wheat most frequently occurs in that form which presents a constriction or other distortion in the topmost sheath. A certain partial floral sterility is noted in geniculate spikes, which thus tend to show fewer (though heavier) grains. The anomaly is not usually of great importance.

The causation of this condition is usually traumatic, the action of strong wind predominating. It can be caused by bending the sheath while still in the boot.

**Colors in the plant world**, K. BORESCH (*Samml. Gemeinnütz. Vorträge*, No. 512-513 (1923), pp. 17).—Study of 200 plants showed the same ratio (3:1) to hold between the two chlorophyll components, *a* and *b*, for all these plants so far as they were not much influenced by external factors. Carotin and xanthophyll were in the ratio 0.6:1. Other color relations are discussed.



## GENETICS.

**Some remarks about units in heredity**, W. JOHANNSEN (*Heredity*, 4 (1923), No. 1-2, pp. 133-141).—A discussion of the more common genetic terms, with suggestions for revision in many cases.

**Introduction to medical biometry and statistics**, R. PEARL (*Philadelphia and London: W. B. Saunders Co., 1923, pp. 379, pl. 1, figs. 87*).—This book presents the general principles of biometry and statistical methods, with special reference to their application to biology and medicine.

**The interpretation of correlation data**, A. B. CONNER (*Texas Sta. Bul. 310* (1923), pp. 5-24, figs. 3).—The interpretation of correlation data is discussed in an endeavor to make clear the uses and limitations of material of this character. The author uses lines of kafir grown at the Lubbock Substation to illustrate the interpretation of population data and pure-line data and the comparative interpretation of population and pure-line data.

**A somatic mutation in the singed locus of the X-chromosome in *Drosophila melanogaster***, O. L. MOHR (*Hereditas*, 4 (1923), No. 1-2, pp. 142-160, figs. 3).—A male fly, occurring in a culture at Christiania University, having singed bristles (curling of the bristles and small hairs) on one side of the body and on the dorsal part of the thorax with normal bristles over the rest of the body and head, is described. Seven daughters of the mutant, when mated with normal males, produced 154 singed males, 199 normal males, and 400 normal females, whereas three other daughters produced no singed offspring, thus indicating that the singed character is due to recessive sex-linked mutant gene which the author suggests has only been produced by one testicle of the mutant, since only part of his daughters were able to transmit the singed character.

In further crosses singed was found to be an allelomorph of the singed factor located at 20.9 in the X-chromosome, but not identical with it, since the homozygous condition of the older factor causes sterility, whereas normal eggs were laid by females homozygous for the new singed factor and by females carrying the old factor in one X-chromosome and the new factor in the other.

In discussing the time when the mutation occurred, the author suggests that it arose in one of the daughter X-chromosomes of the dividing egg nucleus or shortly afterward, as a large part of the body is affected, but certain parts and one testicle were apparently normal. A distinct line on the ventral surface divided the normal from the singed condition.

The symbol  $sn^3$  is suggested for the new gene.

**Experiments on toleration of temperature by *Drosophila***, H. H. PLOUGH and M. B. STRAUSS (*Jour. Gen. Physiol.*, 6 (1923), No. 2, pp. 167-176).—The results of a series of tests of raising different strains of *Drosophila* on banana agar have shown that five or six wild strains of *D. melanogaster* collected from various places, including one strain from Sweden, were able to maintain themselves at a temperature of 31° C. (87.8° F.) for several generations. It was, however, impossible to breed seven mutant strains successfully at this temperature. Other tests indicated that wild strains of *D. virilis* and *Chymomyza procnebris* will reproduce successfully at 31°, whereas wild strains of *D. simulans*, *D. immigrans*, and *D. funebris* were not able to go longer than one or at the most two generations.

Studies of the cause of the inability of some stocks to continue at the high temperatures indicated that these stocks could be maintained if the temperature was lowered for a certain period during each generation. Mutant

flies that were nonproductive because of the high temperature were fertile when mated with males or females that had been hatched at 24° C.

**Head length dimorphism of mammalian spermatozoa**, A. S. PARKES (*Quart. Jour. Micros. Sci. [London], n. ser., 67 (1923), No. 268, pp. 617-625, figs. 3*).—The head length of the spermatozoa of man, rat, cat, and mouse were measured and, except in the case of the cat, were found to show a bimodal distribution when plotted. This result is of interest in connection with the fact that one-half of the sperms should contain two X-chromosomes and the other half only one, which thus might account for differences in size.

**Some remarks about the distance between the genes in *Drosophila melanogaster***, D. ROSÉN (*Hereditas, 4 (1923), No. 1-2, pp. 231-234*).—The author suggests that the difference in the crossing over percentages between genes may be due to a variation in affinity between the genes instead of to the distance between genes.

**Studies on high and low nondisjunction in *Drosophila melanogaster***, G. BONNIER (*Hereditas, 4 (1923), No. 1-2, pp. 81-110, figs. 2*).—The percentages of exceptional offspring occurring in crosses with a high nondisjunction strain of *Drosophila*, which ordinarily produces 22 per cent exceptions, are reported from the University of Stockholm. The experiments were designed to determine the cause of the large percentage of exceptional flies produced by this strain. After eliminating the Y-chromosome, genes located in the autosomes, and cytoplasmic factors as possible causes of the production of the large number of exceptions, the author suggested that the X-chromosomes as a whole were responsible.

Suitable experiments indicated that both X-chromosomes derived from the high nondisjunction strain were required to produce the high percentages of exceptionals, and when only one of the X-chromosomes originating from this strain was present the normal low percentage (4.3 per cent) occurred. In cases of crossing over where part of one of the original X-chromosomes was missing, there was a reduction in the number of exceptionals produced corresponding proportionately to the amount of chromosomes which had been changed. This relationship between the amount of homologous parts of the X-chromosomes coming from the high nondisjunction strain and the percentage of the exceptionals produced was expressed by the formula

$$y=4.3+0.2z$$

in which  $y$  equals the percentage of exceptions and  $z$  the length of the homologous parts of both X-chromosomes which have come from the high nondisjunction strain, 4.3 is the percentage of exceptions produced by low nondisjunction strains, and 0.2 is a constant determined in these experiments.

Since one part of the chromosome was as essential as any other part for high nondisjunction, it is inferred that "the chromosomes consist not only of the genes, but of something else which extends from end to end of the chromosomes and in which the genes are, so to say, embedded" (gene basis). Further experiments to study more thoroughly the possibility of the interaction of a large number of genes as factors in the production of the high percentage of exceptions are being carried on. Several mutants produced during the experiments are also described.

**The numerical relations in the crossing over of the genes, with a critical examination of the theory that the genes are arranged in a linear series**, H. S. JENNINGS (*Genetics, 8 (1923), No. 5, pp. 393-457, fig. 1*).—This is a more detailed discussion of the theoretical analysis of the linear theory of



the arrangement of genes in the chromosomes than was previously noted from two papers (E. S. R., 50, p. 129).

**Analysis of hereditary factors for finger prints**, K. BONNEVIE (*Hereditas*, 4 (1923), No. 1-2, pp. 221-230, figs. 5).—By grading the finger prints of 24,518 individuals, the author concluded from a statistical study at Christiania University of the parents and offspring that five pairs of factors were responsible for the patterns observed. This conclusion was based on the fact that there were only 26 in the zero grade and 28 in the 100 or maximum grade. The ratio between these grades and the total population thus approximates 1:1,024.

Further observations made were of the differences between the grades of both hands of individuals and the greater similarity between the grades of identical twins than between other offspring of the same parents.

**Twins and heredity**, G. DAHLBERG (*Hereditas*, 4 (1923), No. 1-2, pp. 27-32).—Based on the available data from various sources, the author presents evidence to indicate that not only the tendency to produce twins from two ova is inherited, but also the tendency to produce twins from one ovum.

**The heredity of microscopic hair characters in *Peromyscus***, R. R. HUESTIS (*Natl. Acad. Sci. Proc.*, 9 (1923), No. 10, pp. 352-355).—Microscopical hair characters of the  $F_1$  and  $F_2$  hybrids between different species of the deer mouse (*Peromyscus*) were classified into four groups at the Scripps Institution. The following results of the study of the characters observed in the hybrids and parents pointed toward the operation of multiple factors as causes for the differences: The characters were shown to be hereditary by the effect of selection and by parent—offspring correlations; the mean values of both hybrid generations were usually intermediate between the parents; the  $F_2$  distributions showed more variability than the  $F_1$ s and  $F_2$  sibs were also more unlike than  $F_1$  sibs as determined by correlations; and the plotted curves of the  $F_2$ s were shorter and flatter topped than the  $F_1$ s, slight bimodal curves occurring in some cases.

**Heredity of white markings in cattle**, H. FUNKQUIST and N. BOMAN (*Hereditas*, 4 (1923), No. 1-2, pp. 65-80, figs. 10).—The results of a study of the inheritance of white markings on the head of cattle, carried on at the Akarp and Ericsberg Experiment Stations, Sweden, are reported. The authors suggest the operation of three independent factors in determining the amount of white on the head. The homozygous recessive condition of the three factors causes a black head and the homozygous dominant a white head. Different amounts of spotting are produced by the heterozygous condition of one or more of the factors and by differences among them.

**A lethal gene in fowls**, L. C. DUNN (*Amer. Nat.*, 57 (1923), No. 651, pp. 345-349).—This is a brief report of the results of crosses in poultry at the Connecticut Storrs Experiment Station in which matings of a cock heterozygous for color with whites (recessive from Wyandotte) produced colored and white offspring in a ratio of approximately 2 colored : 1 white. There was also found to be a high death rate of embryos during the early incubation period in these eggs. Both of these conditions tended to point toward the operation of a lethal factor linked with *c*.

**A note on the theory of sex determination**, F. SCHRADER and A. H. STURTEVANT (*Amer. Nat.*, 57 (1923), No. 651, pp. 379-381).—Based on the results of Bridges' work dealing with the relation of the X-chromosomes and autosomes to sex determination (E. S. R., 47, p. 172), the authors have assigned numerical values to the X-chromosomes and autosomes and presented a theoretical discussion to indicate that these data do not demonstrate the importance of the

ratio between the number of X-chromosomes present and the number of sets of autosomes.

**Inheritance of kernel and spike characters in crosses between varieties of *Triticum vulgare*,** H. K. HAYES (*Minn. Univ. Studies Biol. Sci.*, No. 4 (1923), pp. 163-183).—Marquis spring wheat was crossed with Preston and with Bluestem in 1915 at the Minnesota Experiment Station with the hope of producing a wheat of as high quality as Marquis, of as good or better yielding ability, and more resistant to scab. Bluestem and Preston produce longer kernels than Marquis, and Marquis and Bluestem produce kernels of somewhat higher texture than Preston. Each family in succeeding generations was the product of a single plant selection made the preceding generation in families which excelled for yield and kernel characters. By the  $F_3$  generation a large proportion of the families appeared homozygous.

Length of kernel appears to be inherited in much the same way as other size characters. All gradations for seed length were obtained from families with as short as, or slightly shorter seeds on the average than, Marquis to families with as long seeds as Bluestem and Preston. The bearded plants in heterozygous  $F_3$  and  $F_4$  families produced kernels which averaged about 1 mm. longer than the kernels produced by awnless plants. Since the bearded families somewhat surpass the awnless families in average length of seed, average percentage of plumpness of seed, and average yield per plant, the author holds that the awn of wheat is an important organ, and the present tendency to breed only awnless wheats should not be adopted in entirety without further experimental studies. Percentage of plumpness of seed is said to be an inherited character and also associated with high average yield per plant. While environment plays a major rôle in determining seed texture, or in hard wheats the percentage of "yellow-berry" kernels, nevertheless heredity is considered of importance. Some strains produce a higher proportion of yellow-berry kernels than others, and in some cases this tendency is inherited.

**Inbreeding in cotton and its importance to the plant breeder,** S. C. HARLAND (*Agr. Jour. India*, 18 (1923), No. 5, pp. 465-474).—The conclusions of Leake and Prasad<sup>1</sup> on the evil effects of inbreeding in cotton are held to need revision in the light of recent genetic investigations. Cases of contabescence observed by Leake are thought to be either of the environmental type or due to the segregation of lethals.

Continued inbreeding has not seemed to result in progressive diminution in fertility as measured by percentage of ovules set, either in Sea Island, by Harland (*E. S. R.*, 42, p. 634), or in Kumpta, by Kottur (*E. S. R.*, 45, p. 634). On the contrary, inbreeding may result in the isolation of types more resistant to shedding than the commercial ancestors.

**On the heterogeneous influence of starvation of male and of female insects on their offspring,** S. KOPEĆ (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 46 (1924), No. 1, pp. 22-34).—The partly starved moths (*Lymantria dispar* L.) reared in the experiments at the Pulawy Government Institute for Agricultural Research, Poland, previously noted (*E. S. R.*, 50, p. 452) were mated with other moths which had been reared on an abundance of food. The offspring received an abundant supply of food, and records were kept as to the duration of the larval life and the effect of starvation of the parents on the vitality and weight of the offspring, as well as other characteristics. The average results are given in the following table:

---

<sup>1</sup> India Dept. Agr. Mem., Bot. Ser., 4 (1912), No. 3, pp. 37-72.



*Data on the characters of the offspring of controls and controls mated with starved males and females.*

Mating.	Average eggs per mating.	Eggs hatched	Caterpillars undergoing pupation.	Chrysalids from which moths emerged	Average of maximum diameter of eggs.	Duration of larval life.		Duration of pupal life.		Weight of chrysalids.	
						♂♂	♀♀	♂♂	♀♀	♂♂	♀♀
Control ♀♀ ×	<i>Number.</i>	<i>P. cent.</i>	<i>P. cent.</i>	<i>P. cent.</i>	<i>Microns.</i>	<i>Days.</i>	<i>Days.</i>	<i>Days.</i>	<i>Days.</i>	<i>Mg.</i>	<i>Mg.</i>
control ♂♂-----	280.7	63.4	27.3	88.7	1,235	52.81	63.21	22.83	19.15	284	759
Starved ♀♀ ×											
control ♂♂-----	132.1	56.8	36.3	85.5	1,237	51.66	63.73	22.21	18.51	304	795
Control ♀♀ ×											
starved ♂♂-----	373.8	78.4	6.8	68.5	1,238	52.22	63.39	21.91	18.45	217	610

In discussing the results, the author states that the starved females lay fewer eggs but the capacity of the eggs to develop and the mortality of the offspring are not changed. When the males are starved, the ability of the sperm to fertilize eggs is unchanged but the mortality of the offspring is greater and the weight of the progeny is decreased. Apparently starvation of the females reduced the number of eggs laid but in the males it reduced the quality of the spermatozoa.

## FIELD CROPS.

**Report of committee on standardization of field experiments, A. T. WIANCKO ET AL.** (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 1, pp. 1-16).—Standards are recommended for field plat experiments in soil fertility and for field experiments with farm crops. The bibliography of standardization of field experiments as given includes, to date, 177 titles.

[**Field crops work in the Philippine Islands**], A. HERNANDEZ (*Philippine Bur. Agr. Ann. Rpt.*, 22 (1922), pp. 71-88, pls. 3).—Experiments reported on were similar to and generally in continuation of earlier work (E. S. R., 48, p. 830).

**Crop atlas of India** (Calcutta: India Com. Intel. Dept., 1923, pp. [2], maps 16).—Outline maps of India show the areas under cultivation and average production of rice, wheat, barley, sorghum, pearl millet, sugar cane, tea, coffee, tobacco, cotton, jute, flax, rape and mustard, sesame, peanuts, and indigo.

**The water requirements of farm crops, A. E. V. RICHARDSON** (*Jour. Dept. Agr. Victoria*, 21 (1923), Nos. 4, pp. 193-212, pl. 1, figs. 8; 5, pp. 257-284, figs. 13; 6, pp. 321-339, figs. 5; 7, pp. 385-404, figs. 7; 8, pp. 449-481, figs. 8).—Investigations were made to determine, for Australian conditions, the water requirements for the principal farm crops and the influence of variety, season, varying moisture saturation, fertilizers, and physical environmental factors on the water requirements of crops. The average transpiration ratio of farm crops at Rutherglen during four years was for peas, 344; barley, 350; wheat, 380; oats, 390; mustard, 414; rye, 421; rape, 490; vetch, 593; and alfalfa, 790.5; and of grain was, for peas, 673; barley, 926; wheat, 1,088; oats, 1,190; and rye, 1,525.

For winter-grown cereals in Australia the period of maximum transpiration occurs during October, winter-grown wheat transpiring during October not less than 40 per cent of the total moisture used and over 80 per cent from September to November, although the growth period extended over 7.5 months. Alfalfa in bloom transpired as much as from 25 to 29 per cent of its total water requirement in three days. The data indicated that the water requirement for cereals in any given season will vary from district to district with the

intensity of the physical environmental factors, and that it closely follows the relative intensity of these factors as expressed in the evaporation from a free water surface during the period of maximum transpirational activity. The water requirement of a given series of crops varies from season to season, and the seasonal variation in the transpiration ratio is closely related to the evaporation from a water surface during the period of maximum transpiration. Passing from the southern coast line of Australia to the interior, rainfall diminishes, humidity decreases, air temperatures increase, and evaporation rapidly increases. Hence, crops raised in the arid regions are likely to suffer from the double disadvantage of shortage of rainfall and a high transpiration ratio.

Varieties of wheat did not differ widely as to the water needed to elaborate a unit of dry matter, but varied considerably in the water requirement for grain, because the proportion of grain to straw varies with the variety. The transpiration ratio for grain varied from 660 for Yandilla King to 1,188 for Kubanka, while the ratio for dry matter ranged from 209 for Yandilla King to 243 for Huguenot. The transpiration ratio for wheat did not vary greatly with soil saturation of from 30 to 90 per cent of the water-holding capacity, but on the whole the water requirement for dry matter was greater in moist than in dry soil and was lowest for soils maintained at moderate degrees of soil saturation. The water requirement for grain, however, consistently and markedly increased as the degree of soil saturation increased, and the migration ratio rapidly diminished with increasing soil humidity.

Application of artificial fertilizers lowered the water requirement of wheat markedly, nitrogen producing the greatest relative reduction in the transpiration ratio for dry matter. The experimental results suggest that with abundant nitrates, as in well-worked fallows, the addition of a soluble phosphate not only increases the vigor of the crop, but materially lowers the transpiration ratio, thus effecting a better utilization of soil moisture. The composition of the crop was materially affected by the fertilizer applied, the most significant changes being caused by nitrogen. Heavy dressings of nitrogen greatly increased the nitrogen content both of the grain and the straw of wheat, and the increase of nitrogen in the grain was accompanied by a marked reduction in the potash content. The potash in the straw was increased and the phosphorus reduced by heavy dressings of nitrogen.

The water requirement of alfalfa is not constant, but varies with the locality, the season, and the period of the year at which it is grown. The transpiration ratio for alfalfa was lower at moderate degrees of soil saturation (60 per cent) than with either extreme. Alfalfa produced dry matter at lower water cost with moderate irrigations (24 to 30 acre-in.) than with either heavy irrigations or no irrigation, and the yield varied directly, but not proportionally, with the water supply up to the limit of 48 acre-in. Superphosphate produced a marked increase in alfalfa yields and a noticeable reduction in the water cost of dry matter produced. The application of gypsum resulted in a substantial and profitable increase in the alfalfa yield.

The transpiration ratio determined for wheat postulates that with moderate rainfalls each inch of rain during the growing period is capable of producing 3.54 bu. of grain. A close relationship was observed between the average wheat yield of South Australia and of Victoria and the average composite seasonal rainfall, 0.94 and 1.09 bu., respectively, being obtained for each inch of seasonal rainfall during 10 years. As the average seasonal rainfall for the wheat belt of the two States is 11.5 in., the maximum wheat yield possible would be 40 bu. per acre. In the Wimmera District, where cultural methods have greatly improved during recent years, the average yield for the past decade is 1.43



bu. per inch of seasonal rain, and for the past 5 years 1.68 bu. Instances of about 3.5 bu. per inch of seasonal rain are cited.

Earliness of maturity and high migration ratio are of great importance in the production of wheats for arid localities. Hybridization is indicated as the most promising method of producing varieties with such characteristics. With the development of hardier strains with low-water requirements, new territories may be subjugated and the utilization of existing areas may be made more effective.

A bibliography of 98 titles is appended.

**New species of grasses from South America**, A. S. HITCHCOCK (*Biol. Soc. Wash. Proc.*, 36 (1923), pp. 195-198).—New species described, including *Bromus villosissimus*, *Lamprothyrsus peruvianus*, *Stipa featherstonei*, and *S. macbridei*, were collected by Macbride and Featherstone in Peru in 1922. *Chloris luetzelburgii* was collected by Lützelburg in Brazil.

**An experiment with corn and other North American soiling and silage crops at Svalöf in 1920**, H. WITTE (*Sveriges Utsädesför. Tidskr.*, 33 (1923), No. 5, pp. 268-275, figs. 4).—Eleven varieties of corn, together with Sudan grass and the more important varieties of sorghos, sorghums, and millets, were grown at Svalöf in a cultural test. Leaming, the leading corn variety, yielded 31,500 kg. of green forage per hectare (28,000 lbs. per acre). Red Amber and Minnesota Amber sorgo produced about 20,000 kg. per hectare, but kafir, feterita, and milo yielded only from 3,900 to 6,100 kg. A yield of 3,000 kg. of green forage per acre was secured from Sudan grass, while the production of foxtail millets ranged from 7,950 to 11,250 kg. and of the proso millets from 4,250 to 4,800 kg.

**Barley breeding at Svalöf**, H. TEDIN (*Sveriges Utsädesför. Tidskr.*, 33 (1923), No. 5, pp. 243-261).—Work in breeding barley by different Swedish investigators is reviewed, and the results secured with newly derived strains are discussed in detail.

Three new crossbred sorts were compared in 35 tests conducted in 13 different localities from 1919 to 1923. Barley No. 0348, a cross between Princess and Chevalier II, gave an average yield of grain 2.7 per cent greater than the corresponding yield of Princess barley, while No. 0252, a cross between Chevalier II and Gullkorn, yielded 3.7 per cent more grain than was secured from Princess; and No. 0190, a cross between Gullkorn and Hannchen, outyielded Gullkorn by 4.2 per cent.

**Cotton experiments, 1923**, J. F. O'KELLY and R. COWART (*Mississippi Sta. Bul.* 219 (1923), pp. 3-12).—Cook with 382 lbs. of lint per acre and Cleveland with 375 lbs. averaged highest in five years' tests at the station (E. S. R., 48, p. 732), while Delfos and Trice led in acre value. Trice, Triumph, and Delfos 6102 led the standard cotton varieties in 1923, and Trice, Cleveland strains, and Lone Star 65 were foremost on hill land. Cleveland×Lewis 63, Cook 307-6, and Cleveland 54 gave the most valuable crops on wilt infested soil. Sodium nitrate and ammonium sulphate have shown the highest net gains in tests of nitrogenous fertilizers. After hoeing appears to be the optimum time of applying sodium nitrate. A cooperative experiment in boll weevil control by means of the calcium arsenate method is reported on.

**The measurable characters of raw cotton, I-III** (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem.*, 2 (1923), No. 27, pp. 353-356; 2 (1924), Nos. 28, pp. 357-363; 29, pp. 364-365).—This series of papers deals with the measurable characters of raw cotton.

**I. The determination of area of cross section and hair weight per centimeter**, G. G. Clegg and S. C. Harland.—The need for quantitative investigations on

the properties of single fibers is emphasized, and methods for the evaluation of the mean area of cross section and fiber weight per centimeter are described.

To obtain a mean value subject to a maximum probable error of not over 3 per cent of the mean entails great care in sampling and at least 140 observations for area of cross section and from 80 to 160 for fiber weight per centimeter. Data on area of cross section and fiber weight per centimeter are presented for five cottons. Calculations of the specific volume, apparent density, and porosity of four cottons show that the amount of pore space varies from 32 to 41 per cent and generally increases with the coarseness of the cotton.

II. *The breaking load of single cotton hairs*, G. G. Clegg.—The frequency array and mean breaking load of single fibers of Peruvian, Afifi, Californian, Punjab-American, and several varieties of Sea Island cottons are tabulated.

The number of observations required after careful sampling to obtain a probable error of less than 3 per cent ranged from 185 in Peruvian to 45 in a pure strain of Sea Island cotton. Diameter was not a test of strength, as Californian and 285F (Punjab-American) cottons had the same diameter, but the breaking load of the former was nearly twice that of the latter. The tensile strength of the wall of the fiber was found much higher with the finer cottons, particularly the pure strain Sea Island, than with coarser cottons such as Peruvian or Texas.

A significant correlation was noted between breaking load and wall thickness within a given variety of cotton. Only a slight correlation, however, existed between the breaking load and the number of convolutions in Sea Island 2M cotton. A definite and significant increase appeared in the mean breaking load of single fibers of Afifi, Californian, and 285F cottons after mercerization without tension at 40° Twad., and the cotton was rendered more uniform in strength from fiber to fiber. The degree of "wastiness" of a cotton may be considered as depending largely on the proportion of thin-walled and weak fibers. It is suggested that the percentage of fibers which break at loads below 1.5 gm. be taken as an index of the amount of thin-walled or dead cotton.

III. *An approximation to the original cell diameter*, M. Calvert and S. C. Harland.—A method is described for estimating fineness in cotton on the basis of the diameter after mercerization with sodium hydroxid. Variations in fineness are revealed by the magnitude of the coefficient of variability. Examples are presented of such determinations in 35 representative cottons, and the application of the method to the classification of outside growths is discussed. The whole range of commercial cottons was comprised between the limits 11.9 $\mu$  and 20.2 $\mu$ , i. e., between the finest Sea Island and coarse Peruvian.

**The effect of seed treatment on the growth of oats**, G. NILSSON (*Sveriges Utsädesför. Tidskr.*, 33 (1923), No. 5, pp. 276–285).—The results of experiments with different methods of treating seed oats for the prevention of smut, carried on by different investigators, are briefly reviewed, and the results of four tests with Uspulun and formalin, used for this purpose, are reported. It was found that the treatment affected the germination of the seed favorably and that the use of formalin did not reduce the rate of growth, while the use of Uspulun apparently had increased it to some extent.

A single test to determine the seed value of kernels of oats produced on the outer and inner parts of the panicle but on the same spikelet is also reported. Of the inner kernels 88.5 per cent, and of the outer kernels 72.5 per cent, had sprouted after 11 days. The seedling plants from the inner kernels also showed the greater rate of growth.



A bibliography of 19 references, pertaining mostly to the seed treatment of oats, is presented.

The determination of the best method for estimating potato yields, together with a further note on the influence of size of seed on the character and yield of the potato, R. N. SALAMAN (*Jour. Agr. Sci. [England]*, 13 (1923), No. 4, pp. 361-389, figs. 8).—The continuation of investigations of the influence of size and character of seed on potato yields (E. S. R., 47, p. 633) gave results similar to those already noted. Allowing for all factors, a seed-piece of about 1.5 oz. is considered the most desirable.

Studies of experimental methods indicated that a plat should contain from 50 to 100 hills and be replicated from 5 to 10 times. When hills are 1 ft. apart in rows 2 ft. 8 in. apart, the area of the plat should range between  $\frac{1}{327}$  and  $\frac{1}{163}$  acre. Long plats are preferable to short, broad plats, since the rows of the long plat can run in the direction of the greatest soil variation. Damage to seed by birds may either result in an indiscriminate loss of plants which will not affect relative yields seriously, or owing to the proximity of roads, buildings, or the presence of workers on neighboring land, the loss from this source may take a definite direction. A further loss of seed tubers, due to the nongrowth of virus-infected tubers, occurs almost exclusively in classes of seed tubers weighing less than 1 oz. and produces a variation which may enhance or decrease that due to soil differences or other cause.

Spacing experiments with sugar beets in Moravia in 1922, F. CHMELÁŘ and J. ŠIMON (*Ztschr. Zuckerindus. Čechoslovak. Repub.*, 47 (1923), Nos. 48, pp. 671-677; 49, pp. 683-694, figs. 2; 50, pp. 695-703, fig. 1; 51, pp. 707-711).—Extensive spacing experiments were carried on in four localities in Moravia in 1922, employing Dobrowitz, an early sugar beet with a high sugar content, and Schreiber, a late variety with an average sugar content. Besides detailed observations on environmental and growth conditions, and yield and agronomic data, an extensive review of earlier spacing tests with sugar beets in Europe is given.

The weight of the root and the foliage increased with an increase in distance between rows (from 40 to 60 cm., or 15.7 to 23.6 in.) and between plants in the row (from 25 to 30 cm.). With increases of 12.5, 25, and 50 per cent in the area per plant the root weight increased from 9 to 15 per cent, 11 to 20 per cent, and 28 to 36 per cent, respectively. Schreiber beets responded to increased spacing by root growth more than did Dobrowitz beets. Both row width and spacing within the row are held important. The influence of increased area on branching of the root appears to be negligible, although slightly noticeable in 60-cm. rows. Increased area prolonged growth and delayed the ripening of the beet.

The enhanced size of the root at a given spacing made up and exceeded the yield loss caused by reduced plant numbers on a given area. The maximum root, foliage, and sugar yields were obtained with the closest spacing, 40 by 25 cm. It is pointed out that the proper spacing differs with the variety, soil, and climatic conditions, and amount and distribution of rainfall. Increasing the row width up to 50 cm. reduced the sugar content of the root only slightly, and at 60 cm. the maximum decrease with Dobrowitz was 0.58 per cent and Schreiber 0.9 per cent. With increased space per plant, the nitrogen content of the dry matter of the root rose slightly and the dry matter was slightly depressed. Dobrowitz beets suffered a smaller reduction in sugar content than did Schreiber beets through the increased area per plant. However, Schreiber beets made the greater gain in roots, so that the sugar yields of the two varieties were similar.



**Conducting comparative field experiments with sugar beet seed, J. URBAN** (*Ztschr. Zuckerindus. Čechoslovak. Repub.*, 47 (1923), No. 22, pp. 299-308, figs. 2).—The directions outlined concern the choice and preparation of the seed, choice of field, method of seeding, spacing, delimiting plats, determining yields, and compiling results and judging their reliability.

**Comparative study of Kavangire, Zwinga, and Cayanna No. 10 sugar canes, P. R. KUNTZ** (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 73 (1923), *Spanish ed.*, pp. 11, figs. 2).—The characteristics, distribution in Porto Rico, and history are given briefly for the Kavangire or Uba, Zwinga, and Biloxi or Cayanna No. 10 varieties of sugar cane.

**A summary of some experiments carried out by the Bureau of Sugar Experiment Stations, VII-X, G. R. PATTEN** (*Queensland Agr. Jour.*, 19 (1923), Nos. 5, pp. 425-433; 6, pp. 474-492, fig. 1; 20 (1923), Nos. 1, pp. 41-45, fig. 1; 2, pp. 71-79; 3, pp. 161-167, fig. 1; 4, pp. 308-314, fig. 1).—Supplementing the agronomic work with sugar cane, by Easterby (*E. S. R.*, 48, p. 631), are analyses of the soils of the sugar districts of Queensland, cane leaves, cane top silage, the juice of cane varieties expressed by a laboratory mill and a large sugar mill, cassava, water hyacinth, green manures, sawdust, and sisal; determination of the nitrogen in trash and green cane leaves; and tests of lead acetate, mercuric chlorid, and formalin as preservatives of cane juice.

**Electrochemical treatment of seed wheat, C. E. LEIGHTY and J. W. TAYLOR** (*U. S. Dept. Agr., Dept. Circ.* 305 (1924), pp. 7, fig. 1).—Purplestraw winter wheat grown from seed subjected to electrochemical treatment (*E. S. R.*, 43, p. 642), immersion in a duplicate salt solution, and in water only, and harvested in 1921 and 1922 at Arlington, Va., gave respective average yields of 27, 25, and 26.5 bu. of grain and 3,884, 3,631, and 3,573 lbs. of straw. Untreated seed made 28.1 bu. and 3,829 lbs. The treatment was not seen to affect plant growth or disease infection.

**Summer attacks of wheat rust, Å. ÅKERMAN** (*Sveriges Utsädesför. Tidskr.*, 33 (1923), No. 5, pp. 262-267).—The comparative rust resistance of wheat varieties is discussed, and a table is given in which the more important Swedish varieties of wheat are arranged according to their rust resistance as shown in experiments conducted in 1916 and 1923. It was found that the same varieties did not show a similar relative resistance to the disease during the two years.

**Milling and baking experiments with American wheat varieties, J. H. SCHOLLENBERGER and J. A. CLARK** (*U. S. Dept. Agr. Bul.* 1183 (1924), p. 94, pls. 5, figs. 23).—Milling and baking experiments were carried on with varieties of American wheats with a view to assisting in the promulgation and enforcement of the official grain standards for wheat and to aiding in improving the quality of the wheat grown. The milling samples studied were obtained from State and Federal experiment stations and from commercial sources. The summarized data, tabulated and discussed for varieties and classes, deal with results obtained from 1915 to 1921, inclusive. The origin, cultural qualities, and productivity of each of the varieties are set forth briefly.

To replace the old varieties on the farms, new varieties of wheat must yield more and be of such good quality as to result in a higher acre return. Since wide variations, due to season and locality, occur within a variety of wheat in the principal milling and baking quality factors, results on less than five samples of a variety are not held a reliable indication of its milling and baking value.

Marquis is considered the best variety of hard red spring wheat (*E. S. R.*, 48, p. 231) in milling and baking quality. Prelude, Pioneer, Ruby, and Kota



are only slightly inferior to Marquis in quality and slightly better than Kitchener, Red Fife, Glyndon, Haynes Bluestem, Power, and Preston.

Kubanka excels all other varieties of durum wheat (E. S. R., 49, p. 37) in baking quality, being followed by Kubanka No. 8, Kubanka No. 98 (Nodak), Arnautka, and Peliss. Pentad, Buford, and Mindum are of poor baking quality. Baking quality, however, is not necessarily considered a measure of the macaroni value of durum wheats.

The leading varieties of hard red winter wheat (E. S. R., 48, p. 231), Turkey, Kharkof, and Kanred, are practically equal in milling and baking value. All of the varieties of this class of wheat are deemed satisfactory for milling and bread making, although Blackhull, Minturki, and Alton are softer and in some respects inferior to the others.

Red Rock has the highest bread-making qualities of the soft red winter wheats (E. S. R., 48, p. 835). Other good varieties are Purplestraw, Odessa, Fulcaster, Fultz, and Buffam No. 17. Varieties said to be poorest in quality are Red Russian, Jones Fife, and Hybrid 123.

Bobs, Hard Federation, White Federation, Federation, and Galgalos are among the best of the white wheats (E. S. R., 48, p. 835) for bread making. Baart, Dicklow, and Pacific Bluestem are of good milling and baking quality, while Goldcoin and the club wheats (E. S. R., 49, p. 335), Hybrid 128 and Little Club, are low in bread-making qualities.

Comparison of the milling and baking qualities of the various classes of wheat shows that hard red spring averaged lowest in test weight per bushel of dockage-free wheat, and in yield of "straight" flour, and highest in volume of loaf. It also averaged high in protein content and yield of shorts. This class and soft red winter showed the highest yields of bran.

Durum wheat averaged highest in test weight per bushel, protein content, yield of shorts, water absorption of flour, weight of loaf, and ash content of flour; averaged lowest in yield of bran and in color score of bread; and was low in yield of flour.

Hard red winter wheat averaged highest in yield of flour and in color and texture of bread; second highest in test weight per bushel, yield of bran, water absorption of flour, and weight of loaf; and lowest in yield of shorts. Soft red winter averaged second highest in yield of flour; lowest in crude protein of wheat and in water absorption of flour; and second lowest in yield of shorts and in weight, color, and texture of loaf. It was one of the three classes averaging lowest in ash content of flour.

White wheat did not excel in any factor, its best points being its high color score and low ash content of flour. It averaged lowest in volume, weight, and texture of loaf, and second lowest in test weight per bushel and crude protein content of wheat and in water absorption of flour.

**Proceedings of the fourteenth and fifteenth annual meetings of the Association of Official Seed Analysts of North America** (*Assoc. Off. Seed Anal. North Amer. Proc.*, 14-15 [1921-22], pp. 149, figs. 12).—Concise summaries of the activities of the association during 1921 and 1922 are included, together with papers presented at the fourteenth annual meeting at Toronto, December 28-30, 1921, and at the fifteenth meeting at Chicago, June 21-23, 1922. The following papers were presented at the fourteenth meeting:

Educating the Seedsman in Seed Testing, by F. H. Hillman; Cooperative Work Between State Seed Laboratories and the Seed Trade, by A. K. Peitersen; Application of Seed Legislation in Canada, by C. Sweet; Relative Value of Green and Ripe Seeds in Alfalfa and Sweet Clover, A Duration Test of Hard Seeds in Alfalfa, Sweet Clover, and Red Clover, 1921, A Study of Methods in

Making Germination Tests, and Germination of Newly Threshed Grains, all by W. O. Whitcomb; Some Notes on Hard Seeds in Alfalfa, and Weed Seeds in California Cereals, both by A. M. Lute; The Behavior of Hard Seeds of Certain Legumes when Subjected to Conditions Favorable to Germination, by E. F. Hopkins; The Identification of the Seed of Alfalfa from Argentina, by H. H. Henry; Seed-like Stone-cell Bodies in Commercial Seed, by E. F. Serrine and E. H. Toole; The Quality of Packeted Vegetable Seeds in Virginia during 1921, by G. T. French; The Influence of Soil Temperature and Moisture on the Germination of Wheat Treated with Different Seed Treatments, by J. G. Dickson; The Copenhagen Conference, by G. H. Clark (E. S. R., 50, p. 237); The Practical Value of Germination Tests of Certain Seeds and Some Factors Affecting the Test, by M. T. Munn; Progress Report on the Germination of Dormant Wheat, by E. H. Toole; The Analyst's Interest in Dormancy Problems, by E. H. Toole and W. L. Goss; Is It Possible to Prevent Wide Variations in the Germination of Crimson Clover Seed? by C. M. Bass; Studies of the Germination of Beet Seed, by J. G. Fiske; Effect of Storage on the Germination of Blue Grass Seed, by B. C. Hite; Tests to Determine the Effect of Temperature and Time of Exposure upon Germination of Cotton Seed, by M. E. Woodbridge and R. E. McDonald; Italian Red Clover Seed, by A. J. Pieters; and A Method to Determine Whether Seed Is That of the Annual or of the Biennial White Sweet Clover, by A. J. Pieters and L. W. Kephart.

Among papers given at the fifteenth annual meeting were Some Experiments with a New Substratum Used in Germination Testing with Observations on Moisture Relations, by E. F. Hopkins; A Preliminary Report on Blue Grass Germination, by E. H. Toole; The Germination of Kentucky Blue Grass Seed in Blotters, Bell Jars, and Petri Dishes, by W. L. Goss; The Testing of Brome Grass and Wheat Grass Seeds, by O. A. Stevens; The Problems of a Commercial Seed Analyst, by W. C. Pfaender; Safeguards in Garden Seed Business, by L. H. Vaughan; Difficulties Encountered by Field Seedsmen in Securing Clean Seeds, by G. S. Green; Cooperation between Seed Trade and Analysts, by W. L. Oswald; Testing Lawn Grass Seed Mixtures, by M. T. Munn; and Extension Work in Indiana with Weeds and Seeds, by A. A. Hansen.

**The influence of manuring on the weed flora of arable land**, K. WARINGTON (*Jour. Ecology*, 12 (1924), No. 1, pp. 111-126; *abs. in Rothamsted Expt. Sta., Harpenden Rpt. 1921-1922*, pp. 32, 33).—Examinations were made of the weed species present on the variously fertilized plats of fields at Rothamsted cropped continuously for a considerable period with winter wheat (Broadbalk field), spring barley (Hoos field), and mangels (Barn field).

The chief factors which determine the dominant species appear to be the crop and the methods of cultivation, the most important weeds being quite different in the three fields. Winter fallowing influences the weed flora very noticeably. However, in the event of any serious deficiency, such as an inadequate nitrogen supply or a prolonged application of ammonium salts only, the fertilizer treatment becomes the prime factor and the flora undergoes modification of a similar nature, irrespective of the methods of cultivation. In such cases a perennial type such as *Equisetum arvense*, *Tussilago farfara*, or *Cirsium arvense* was invariably predominant.

## HORTICULTURE.

**Vegetable crops**, H. C. THOMPSON (*New York and London: McGraw-Hill Book Co., Inc., 1923*, pp. IX+478, figs. 32).—Bringing together in available form the most significant results of investigational work in vegetable gardening, this book is primarily designed for the use of college and university teachers.



**Cabbage production in California**, H. A. JONES (*California Sta. Circ.* 262 (1923), pp. 22, figs. 9).—Information of a general nature is presented regarding climatic and soil requirements, seasons of production, raising of young plants, varieties, field planting and culture, harvesting and grading, and control of insect and disease pests.

**Quality in canned sweet corn as affected by variety and degree of maturity**, C. A. MAGOON (*Canner*, 58 (1924), No. 11, II, pp. 116-119).—Investigations carried on by the U. S. D. A. Bureau of Plant Industry with 15 sweet corn varieties failed to show any significant varietal differences in the quality of the canned product provided the ears were harvested at the proper stage of maturity. The age of the ears utilized in the experiment was accurately determined by labeling at the initial appearance of silk. Weighings made at 5-day intervals showed the average gross weight of the ears of the 15 sweet corns to increase up to the twenty-fifth day, after which it remained practically constant. The percentage of cut corn, on the other hand, continued to increase even to the 30-day stage.

A puncturing apparatus designed by the author for studying the changes in toughness of the kernels in relation to the stage of maturity showed conspicuous varietal differences. As indicated in tests repeated at 5-day intervals beginning with the tenth day following the commencement of silking, the kernels of certain varieties, for example, Country Gentleman and Kelly Hybrid, were found to be consistently more resistant to puncture than were those of other varieties, namely, Golden Bantam, Dreer Golden Giant, etc. In all varieties the increase in toughness progressed rapidly.

Chemical determinations showed that up to the fifteenth day following the appearance of silk the total sugars increase progressively, then decrease sharply, followed by a less rapid decrease to the thirtieth day, the end of the observations. Contrary to expectation, the sugar changes were similar for all varieties, including the field forms, irrespective of the earliness or lateness of the variety.

Canning tests of all varieties at age intervals of 5 days, beginning at the fifteenth day and continuing up to the thirtieth, showed that, with the possible exception of Golden Bantam, Dreer Golden Giant, Morse Golden Cream, Crosby, and Hickok Improved, all varieties were too immature at the fifteenth day to yield a product of desired consistency. At the twentieth day all varieties were in proper condition, and at the twenty-fifth all varieties except a few of the very latest sort were well past prime canning condition. Apparently there was a definite brief period of about 6 or 7 days when the sweet corns were in condition to yield a prime canning product. Quality in canned corn is believed to depend not so much upon variety as upon the stage of maturity and promptness with which handled.

**Tomato production in California**, J. T. ROSA (*California Sta. Circ.* 263 (1923), pp. 19, figs. 6).—This circular presents general information on the importance of the tomato growing industry in California, location of the producing regions, choice of sites, rotations, production of plants, field culture, irrigation, harvesting, varieties, seed production, and control of pests.

**A study of growth in summer shoots of the apple with special consideration of the rôle of carbohydrates and nitrogen**, E. M. HARVEY (*Oregon Sta. Bul.* 200 (1923), pp. 5-51, figs. 27).—That ringing, defoliation, and ringing plus defoliation of young apple shoots results in peculiar growth and internal responses was indicated in biometrical and chemical studies at the station. The ringing on June 20 of Gano and Esopus (Spitzenburg) resulted in a greater length increase than was made by control shoots. Rome shoots, on the other hand, were retarded by the ringing treatment. Defoliation retarded



development in all three varieties, and defoliation plus ringing resulted in the practical cessation of growth. Defoliation accelerated or retarded growth according to the stage of development of the shoots at the time of treatment and, to some extent, according to the portion of the shoot treated. Response of shoots to ringing also varied according to the time of treatment. Early in the season ringing retarded growth, later accelerated, and finally retarded again. Defoliation and ringing had reciprocal effects, namely, when ringing accelerated growth, defoliation, under the same conditions, nearly always retarded growth, and vice versa. Observations upon the regeneration of the basal portions, the area below the girdle or defoliated region, showed maximum regeneration in those shoots subject to a combination of ringing and defoliation. Measurements taken at frequent intervals of the growth development of untreated Grimes and Arkansas Black shoots showed a rapid initial rate, followed by a long period of very slow change.

Chemical analysis of the tip, middle, and basal portions of shoots gathered at intervals throughout the season showed consistent and uniform changes in accordance with the time gathered. Even in untreated shoots relatively large chemical differences were found between the tip, middle, and basal portions. Water soluble solids, phloridzin, and soluble and insoluble nitrogen, those substances which normally decrease throughout the season, were always most abundant in the tip regions and least abundant toward the base. Conversely, substances such as insoluble solids, sugars, polysaccharids, and total carbohydrates, tending to increase during the season, were least abundant in the tip and most abundant in the basal portion. As compared with normal shoots, there was found in the upper portions of defoliated shoots an increased percentage of water soluble solids, phloridzin, and nitrogen and a decrease of insoluble solids, sugars, starch, pentosans, total polysaccharids, total carbohydrates, and the carbohydrate nitrogen ratio. The chemical changes occurring in the bases of the defoliated shoots differed from those of the upper defoliated portion only in being less in degree. The chemical changes produced by ringing were in the upper portion of the shoot the reverse of those resulting from defoliation, that is to say, water soluble solids, phloridzin, and nitrogen were decreased, while insoluble solids such as sugars, starch, and pentosans were increased. The most striking chemical changes were produced as a result of ringing plus defoliation. In this case the responses of the upper portion of the shoot were the same in quality, however, as those noted above for defoliation. Carbohydrates were probably the limiting factor to growth in these shoots, since their content of water and nitrogen was the highest. Chemical analyses of the basal portion of shoots representing the various treatments showed that the changes produced were all of the same quality as the responses mentioned for defoliation and ringing plus defoliation. In order of decreasing quantity these are (1) ringing plus defoliation, (2) ringing, (3) defoliation, and (4) no treatment, arranged in the same order as the regenerative activities of the bases.

**The assimilation of the principal nutrients by the grape,** H. LAGATU (*Ann. École Natl. Agr. Montpellier, n. ser., 17 (1922), No. 4, pp. 251-269, figs. 3*).—A study of the results of analyses of the leaves, shoots, and fruit gathered at regular intervals throughout the growing season indicated that distinct seasonal changes occur in the nutritional requirements of the grapevine. Furthermore, the several parts of the vine varied according to the season in the intensity of their particular requirements, for example, at harvest the leaves made special use of lime alkalinity, less of magnesium, and much less of potassium, while at the same time the fruits used potassium in particular and less of lime and magnesium. Considering the vine as a whole, lime alkalinity was



used slowly at first, but at the time of blossoming the rate of use became much more rapid than that of potassium and magnesium. The use of potassium is quite large at the flowering season, becoming almost negative in midsummer and strong again at the end of the season. The rate of use of magnesium was found to be quite constant.

In conclusion, it is pointed out that lime is not only the dominant alkalinity for fruit formation, but also is the dominant need of the leaves in their full stage of activity. It is emphasized that the fact that the soil contains an abundant supply of potassium does not signify that this material is present in an available form. Fertilization practices should assure an abundant supply of nitrogen throughout the season, of phosphoric acid at the beginning of growth, and of available potassium both at the beginning and the end of the season.

**Longevity of the olive**, G. SAVASTANO (*Ann. R. Staz. Sper. Agrumic. e Fruttic. Acireale*, 7 (1923), pp. 71-88, pls. 5).—In this abundantly illustrated paper the author, after discussing the unusually long life of the olive tree, points out certain growth structures whereby old and decrepit trees often regenerate themselves. Sprouts may arise from the vicinity of the roots or from stubs of broken limbs. In addition, nipple-like protuberances consisting of new organic tissue and bearing adventitious buds and roots, sometimes occur on the main trunk and if separated therefrom are capable of developing into new trees.

**Quarantine procedure to safeguard the introduction of citrus plants: A system of aseptic plant propagation**, W. T. SWINGLE, T. R. ROBINSON, and E. MAY, JR. (*U. S. Dept. Agr., Dept. Circ. 299* (1924), pp. 15, figs. 13).—The equipment, methods of technique, and general precautions observed in the introduction, propagation, and dissemination of newly introduced citrus plants are outlined.

## FORESTRY.

**Reforestation**, C. L. McNARY ET AL. (*U. S. Senate, 68. Cong., 1. Sess., Rpt. 28* (1924), pp. 29).—This is a report of the findings of the Select Committee on Reforestation of the U. S. Senate. The material presented was obtained in a nation-wide survey of the forest situation in the United States, in which an effort was made to ascertain the extent of the timber supply, the present status of the lumber industry, and the need of reforestation.

**Forest conservation, with special reference to Michigan**, R. WATSON (*Ann. Arbor: Mich. Forestry Assoc., 1923, pp. 64, pl. 1, figs. 10*).—A popular statement of the actual condition of the Michigan forests, pointing out the existence of large areas of idle and waste land and presenting an urgent plea for intelligent reforestation.

**Experimental forestry, forest protection, and timber products export** (*Goteborg: Jubilee Exhibition, 1923, pp. 66, figs. 19*).—This pamphlet, excerpted from the complete catalogue in Swedish prepared in connection with the Jubilee Exhibition at Goteborg, in 1923, discusses the organization, equipment, and some experimental activities and accomplishments of the Swedish State Institute of Experimental Forestry.

**A primer of forestry** (*Perth, Australia: Dept. Education, 1921, pp. 115, pl. 1, figs. 78*).—This pamphlet, prepared under the supervision of C. E. Lane-Poole, conservator of forests, consists chiefly of descriptive information upon the principal forest trees of Western Australia.

**Relative humidity and forest fires**, J. V. HOFMANN and W. B. OSBORNE, JR. (*U. S. Dept. Agr., Forest Serv., 1923, pp. [12], pls. 5*).—The important relation of relative humidity to forest fires was shown in studies conducted at the Wind River Forest Experiment Station, Wash., where it was found that fires

did not spread when the relative humidity was about 60 per cent. Between 50 and 60 the rate of spread was slow and dangerous only in highly inflammable material. Between 40 and 50 the fires gained in vigor, varying from a few running fires to those that merely smouldered. Between 30 and 40 per cent fires gained headway, and below 30 per cent fires soon spread beyond control. Crown fires occurred when the humidity dropped to 25 per cent or below. The instruments for determining the relative humidity are discussed and illustrated.

**The trees of California**, W. L. JEPSON (*Berkeley, Calif.: Sather Gate Bookshop, 1923, 2. ed., pp. 240, pl. 1, figs. 128*).—This is a second edition of the work previously noted (E. S. R., 22, p. 451).

**The relation of bark to diameter and volume in redwood**, J. E. PEMBERTON, JR. (*Jour. Forestry, 22 (1924), No. 1, pp. 44-48, fig. 1*).—Measurements taken upon virgin and second growth redwoods in Del Norte, Humboldt, and Mendocino Counties, Calif., indicated that the ratio between bark thickness and the diameter outside of the bark at any given point is practically a constant for any group of trees. The character of the site had little apparent effect on this ratio, which averaged 15 per cent at breast height. Advancing up the trunk the ratio gradually diminished to 10 per cent at three-fourths total height. Locality, crown class, or age up to 100 years had no significant effect on the ratio. In virgin timber the bark ratio at breast height was approximately 13 per cent. The bark volume was estimated at 27 per cent of the total volume of the bole, or 37 per cent of the wood volume from the ground to the tip.

**The white cedar of the Dismal Swamp**, A. AKERMAN (*Va. State Forester, Forestry Pub. 30 (1923), pp. 21, pls. 8*).—Information obtained as a result of cooperative investigations carried on by the States of Virginia and North Carolina and the U. S. D. A. Forest Service concerning the silvics of white cedar (*Chamaecyparis thyoides*) as grown in the Dismal Swamp area is presented.

Measurements indicated that pure stands attain their most satisfactory development at about 80 years of age. Because of unusual tolerance to crowding, yields in pure stands are unusually large despite the relatively small size of individual trees. White cedar wood, because of its lightness, easy working characters, and unusual durability under moist conditions, is in great demand for the manufacture of buckets, tubs, etc. General observations on reproduction following cutting led to the suggestion that two vigorous seed trees should be left per acre. In respect to the agricultural value of the cedar swamps, it is believed that at the present time the land is much more valuable for timber growing. A volume table for white cedar is presented.

**The cork oak in Tunis**, F. DÉBIERRE (*Le Chêne-Liège en Tunisie. Tunis: Dir. Gén. Agr., Com. et Colon., Dir. Forêts, 1922, pp. 60, pl. 1*).—General information is presented concerning the distribution of the forests, methods employed in gathering bark, protection from forest fires, and utilization of the cork.

**Production of maple sirup and sugar**, A. H. BRYAN, W. F. HUBBARD, and S. F. SHERWOOD (*U. S. Dept. Agr., Farmers' Bul. 1366 (1923), pp. 35, figs. 15*).—This bulletin is a revision of and supersedes Farmers' Bulletin 516 (E. S. R., 28, p. 344).

**Austrian and Czechoslovak lumber and woodworking industries**, C. H. FOSTER, W. A. FOOTE, and C. M. RAVNDAL (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform. Bul. 196 (1924), pp. 16*).—This bulletin contains information on the lumber industry and allied trades.



## DISEASES OF PLANTS.

**The dissemination of plant diseases by seed**, C. R. ORTON (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 54).—Attention is called to the numerous diseases of crop plants that are disseminated upon or within the seed.

**Soil temperatures obtained under a steam pan**, N. R. HUNT and F. G. O'DONNELL (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 53).—An investigation is reported of soil temperatures under a steam pan, and the results indicate that the temperatures varied with the soil type and condition and with the condition of the steam, whether wet or dry. Steaming for 75 minutes under a pan raised the soil temperature to near the boiling point for a depth of 7 in. or more with steam at 90 lbs. pressure.

**Leaf roll, mosaic, and certain other related diseases in Idaho**, C. W. HUNGERFORD (*Phytopathology*, 12 (1922), No. 3, pp. 133–139, pl. 1).—A detailed account is given of investigations conducted by the author on leaf roll, mosaic, russet dwarf, and calico, preliminary accounts of which have been noted previously (E. S. R., 45, p. 240; 47, p. 749; 49, p. 745).

**Studies on plant cancers, IV**, M. LEVINE (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 56).—Continuing previous work (E. S. R., 48, p. 843), an account is given of the effect of inoculating various quantities of different dilutions of *Bacterium tumefaciens* into the tobacco plant. The results indicate that a smaller number of bacteria favorably lodged in tissue capable of response would produce a crown gall equal in size to that produced by a larger number. The size of the crown gall is held to be dependent upon the region of inoculation and the vitality of the host rather than on the number of bacteria causing the infection.

**Studies of crown gall**, A. J. RIKER (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 55, 56).—Studies of crown gall on tomatoes and raspberries produced by an organism isolated from the black raspberry have shown that no standard varieties of red or black raspberries are strikingly resistant to the disease. On the tomato infection was secured only through wounds and at temperatures below 30° C. (86° F.).

**Some morphological responses of the host tissue to the crown gall organism**, A. J. RIKER (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 9, pp. 425–436, pls. 6).—In a previous paper (E. S. R., 50, p. 42) an account was given of inoculation studies of crown gall on tomato stems. In the present contribution the author reports further studies on the response of the tissues of the host to the organism, and descriptions are given of secondary tumors and tumor strands which are produced.

The crown gall bacteria were consistently found in an intercellular position, and the bacteria appeared to be associated with a change in neighboring cells which was manifested in various ways. The bacterial stimulus is said to apparently attract the dividing nuclei to the adjacent part of the cell and thus to disturb the polarity of the cell.

The manner of cell division in the early stages is said to indicate the source of the stimulus and the position of the bacteria. In older galls this relation did not appear so clear. The younger galls appeared to be composed of groups of sheaths or strands of tumor tissue surrounding invaded intercellular spaces.

Tumor strands and secondary tumors were secured only when the inoculation puncture was made in the region of elongation close behind the condensed buds of such plants as sunflower, sweet pea, and tobacco. The elongation of the internodes in the condensed bud above the puncture was found to be of very great importance in the separation of the secondary galls from the point of puncture. A heavy inoculation of the growing region prevented the expansion

of the internodes. No evidence was found to indicate that secondary tumors and tumor strands invade the normal tissues. They are considered to be part of the primary gall which was carried up by the elongation of the invaded region. The specialized tumor tissue found in secondary galls is believed to develop independent of any relation to the primary galls.

**Additional hosts for *Bacterium solanacearum***, F. A. WOLF (*Phytopathology*, 12 (1922), No. 2, pp. 98, 99).—The author reports having repeatedly isolated in the laboratory and studied for a number of years strains of *B. solanacearum* from the soy bean, dahlia, and cosmos.

**Experimental evidence relating to the nature of the mosaic virus**, J. JOHNSON (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 52).—As a result of studies made in which temperature and humidity were controlled, the author believes that the evidence secured is opposed to the enzymatic theory of mosaic, while at the same time the data are believed to favor parasitic hypothesis.

**Alkaloidal content of *Daturas* affected by mosaic injury**, E. E. STANFORD and E. D. DAVY (*Science*, 58 (1923), No. 1509, pp. 450, 451).—Analyses of both green-stemmed and purple-stemmed plants of *Datura stramonium* showed a considerably higher alkaloidal content from mosaic plants than from normal ones.

**Data relative to the germination of aeciospores, urediniospores, and teliospores of *Puccinia coronata***, G. R. HOERNER (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 108).—The author claims that aeciospores from herbarium specimens of *Rhamnus* were not viable after a period of 167 days from the date of collection. Urediniospores from herbarium specimens of oats proved to be viable as long as 87 days after the date of collection. Unprotected urediniospores lost their viability within 22 days with a minimum temperature of  $-27^{\circ}$  F. and a maximum of  $42^{\circ}$ . When protected with a range of temperature similar to the above, these spores remained viable as long as 44 days. Exposed to light they lost their germination within 23 days. When in the dark they remained viable as long as 79 days at temperatures ranging from 29 to  $86^{\circ}$ . Teliospores developed on oat seedlings in the greenhouse and not afforded a period of overwintering did not germinate.

**Miscellaneous studies with crown rust of oats**, G. R. HOERNER (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 108).—The author claims that urediniospores borne on the surface of oats seed do not offer a ready means of infecting seedlings developed from these seeds. No perennial mycelium capable of producing a new crop of urediniospores after overwintering was found under Minnesota conditions. Urediniospores were not found to remain viable over winter on oats, nor did continued production take place. The situation regarding the occurrence of wild grasses was not determined. Environmental factors were found to influence the development of the rust on oats as well as the rate of pustule formation. Etiolation brought about the early formation of telia on oat seedlings. The appearance of telia on seedling oat leaves is not considered a reliable basis for determining resistance of oat varieties.

**The take-all disease of cereals and grasses**, R. S. KIRBY (*Phytopathology*, 12 (1922), No. 2, pp. 66-68, pls. 3, figs. 3).—A detailed account is given of investigations on the take-all disease of wheat, the occurrence of which in New York has been previously noted (E. S. R., 44, p. 343). Subsequent studies have proved the identity of this disease with that occurring in Europe and Australia caused by the fungus *Ophiobolus cariceti*. Inoculation experiments have shown that the fungus attacks wheat, barley, rye, and one or more species of the wild grasses, *Agropyron*, *Bromus*, *Elymus*, *Festuca*, *Hordeum*, *Hystrix*, *Lolium*, and *Phalaris*. None of the 54 varieties of wheat tested in the greenhouse showed any marked degree of resistance to the disease.



The most promising methods of control were believed to be the practice of 4- to 5-year rotations, eradicating wild grass and volunteer grain which may act as hosts, discontinuing the practice of returning wheat stubble in manure for three years preceding the planting of wheat, cleaning the wheat seed thoroughly to remove all bits of straw, and discontinuing the practice of liming the soil immediately before planting wheat.

**Occurrence of *Tylenchus dipsaci* on alfalfa in Oregon,** M. B. MCKAY (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 105).—The occurrence of *T. dipsaci* on diseased alfalfa plants is reported. In addition, this nematode is known to occur on clover and strawberries and has been found causing considerable damage to these plants in both irrigated and nonirrigated regions.

**A new disease of asparagus,** M. T. COOK (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 49).—A disease of asparagus characterized by brownish lesions on the stem and a heavy infection with *Fusarium* sp. is reported.

**Celery mosaic,** R. F. POOLE (*Phytopathology*, 12 (1922), No. 3, pp. 151–154, pl. 1, fig. 1).—A description is given of a mosaic disease of celery observed on different varieties grown in New Jersey.

**Further evidence of insect dissemination of bacterial wilt of corn,** F. V. RAND and L. C. CASH (*Science*, 59 (1924), No. 1516, pp. 67–69).—In a previous publication (*E. S. R.*, 45, p. 352) an account was given of the authors' studies of the bacterial wilt of corn due to *Aplanobacter stewarti*, in which soil and seed transmission of the disease were discussed. Some evidence was found that indicated transmission through the seed. Later studies are said to indicate that the secondary spread of the wilt during the growing season is due to flea beetles, especially *Chaetocnema pulicaria* and *C. denticulata*. While it was not definitely settled, there is believed to be evidence that is strongly in favor of the theory that the sporadic appearance of the early cases of wilt is due to the southern corn rootworm (*Diabrotica 12-punctata*).

**Studies on corn rust,** G. F. WEBER (*Phytopathology*, 12 (1922), No. 2, pp. 89–97, figs. 3).—In connection with studies on corn rust (*Puccinia sorghi*) data were obtained on (1) the relation of temperature to germination of urediniospores, (2) the relation of temperature to infection by urediniospores, (3) mode of host penetration in uredinial infection, (4) overwintering of urediniospores, and (5) relative susceptibility of corn species. It was found that the minimum, optimum, and maximum temperatures for germination of urediniospores of corn rust are 4, 17, and 32°, C., respectively. The optimum temperature for infection is about 18° (64.4° F.). The germ tubes are able to enter the stomata of the corn plant either with or without the formation of appressoria. In the vicinity of Madison, Wis., during the winter of 1919–20, urediniospores did not overwinter. There are said to be rather definite differences in susceptibility to the rust in the different species of corn.

**Habits of the cotton root rot fungus,** C. J. KING (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 9, pp. 405–418, pls. 7, figs. 4).—The results are given of a study made in the Salt River and Gila Valleys of Arizona of the cotton root fungus *Ozonium omnivorum*, particular attention being paid to its occurrence on alfalfa.

In alfalfa fields the disease is said to spread radially and to form almost perfect circles, the more recent activity being defined by the ring of recently wilted plants on the circumference. The author reports the occurrence of conidial mats, such as have been described by Duggar (*E. S. R.*, 36, p. 146), and with but few exceptions these are said to appear only in close proximity to the plants that have most recently succumbed to the disease. The chief requisites for fructification of the fungus are said to be a heavy type of soil with a dense cover crop and humid weather, accompanied by intermittent rainfall.

The rate of enlargement of regular circles in alfalfa fields is said to have been about 8 meters (26.24 ft.) increase in diameter per year. In cotton fields regular circles increased in diameter about 9 meters in 50 days. The behavior of the root rot in alfalfa fields is said to resemble that of fungus fairy rings in spreading radially, in areas becoming free from the disease, and in the formation of fruiting bodies about the ring of most recent activity.

Saturating the soil with formaldehyde solution around the centers of infection was tried and found to be an effective means of control.

**Cotton wilt a seed-borne disease**, J. A. ELLIOTT (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 50, 51).—From a study of cotton seed delinted with concentrated sulphuric acid and afterwards strongly surface sterilized with corrosive sublimate, the author concludes that cotton wilt due to *Fusarium vasinfectum* is carried by the seed.

**Comparative susceptibility of European and American varieties of cucumbers to bacterial wilt**, S. P. DOOLITTLE (*Phytopathology*, 12 (1922), No. 3, pp. 143-146).—As a result of inoculation experiments, it was found that the European varieties of cucumbers showed a much greater percentage of wilt infection than the American varieties. It was also noted that the European varieties were extremely susceptible to the hot, dry weather prevailing during the summer.

**Cercospora leaf spot of eggplant**, C. G. WELLES (*Phytopathology*, 12 (1922), No. 2, pp. 61-65, figs. 2).—A description is given of a disease of eggplants appearing in the Philippine Islands that is attributed to *C. melongenae* n. sp. The disease was readily controlled by spraying with Bordeaux mixture, but as the yield was not appreciably increased it was doubted whether the treatment would prove commercially profitable.

**Bacterial root rot of horse-radish in New Jersey**, R. F. POOLE (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 49).—A bacterial root rot of horse-radish is said to cause from 4 to 28 per cent of loss on truck farms near Newark, N. J. Cutting off an inch or so at each end of the roots at the time of planting and treating with corrosive sublimate and formaldehyde are said to reduce loss due to this cause.

**Downy mildew: A transit disease of lettuce**, G. K. K. LINK (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 48, 49).—The author reports observing in the market lettuce shipments from California, New York, Texas, and Washington infected with downy mildew caused by *Bremia lactucae*.

**Pathogenicity of *Macrosporium parasiticum***, N. G. TEODORO (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 50).—It is stated that *M. parasiticum* is found repeatedly in Wisconsin on onions, where it apparently causes distinct lesions on leaves and stems. Investigations seems to indicate that the fungus is capable of acting independently as an aggressive parasite.

**An important disease of onions in Porto Rico**, R. A. TORO (*Porto Rico Dept. Agr. and Labor Sta. Circ. 71* (1923), Spanish ed., pp. 6, fig. 1).—A serious disease of onions in Porto Rico is described. Examinations of infected material showed the presence of the fungus *Macrosporium parasiticum*, as well as of a number of sucking insects. It was not determined which was the primary cause of the trouble. Spraying with nicotin solutions is said to have controlled the insects, but no treatment was found successful for combating the fungus.

**The relation of rain to the formaldehyde treatment of onion smut**, C. T. GREGORY (*Phytopathology*, 12 (1922), No. 3, pp. 155, 156).—Attention is called to the effect of frequent rains on the leaching away of the formaldehyde from furrows in which onion seed had been planted.



**Yellow dwarf of potatoes**, M. F. BARRUS and C. C. CHUPP (*Phytopathology*, 12 (1922), No. 3, pp. 123-132, pls. 2, fig. 1).—A disease of potatoes is described that has appeared in a number of localities in New York. The most marked characteristics of the disease are a dwarfing and yellowing of the plants and often the production of small tubers that are sometimes conspicuously cracked. The flesh of the tubers is discolored with rusty brown specks. Infected tubers are said to be worthless for table use or for seed. The cause of the disease and methods of control have not been determined.

**Stem rot diseases of sweet potatoes in New Jersey**, M. T. COOK and F. R. POOLE (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 51).—Stem rots of sweet potatoes caused by *Fusarium hyperoxysporium* and *F. batatis* are said to be abundant in New Jersey. The Big Stem varieties are reported to be more resistant to stem rot than the smaller-stem varieties, and the Big Stem Jersey strains developed from sprouts were found to vary in resistance to the stem rot disease.

**Nonparasitic leaf spots of tobacco**, J. JOHNSON (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 52).—Attention is called to a variety of spot diseases commonly designated as rust. These are said to be due to an inherent physiological predisposition to spotting, to unbalanced nutrition, to absorption of toxic agents, and to toxic agents applied externally.

**A leaf-spot disease of tobacco caused by *Phyllosticta nicotiana***, F. A. WOLF (*Phytopathology*, 12 (1922), No. 2, pp. 99-101).—A brief description is given of a leaf spot of tobacco which is due to a species of *Phyllosticta*, the specific identity of which was not determined. It is said to differ somewhat from *P. tabaci* occurring in Italy and is very different from *Phoma nicotianae* from France. It is thought possible that the fungus may be identical with *Phyllosticta nicotiana*, the type material of which is said to have been lost.

**Preliminary report on a study of the wildfire disease of tobacco**, C. M. SLAGG (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 51, 52).—Studies were carried on of the wildfire disease of tobacco caused by *Bacterium tabacum*, and comparisons were made between the organisms as described by Wolf and Foster (*E. S. R.*, 38, p. 150) and that occurring in northern tobacco fields. The diseases are believed to be identical, but the organisms differ in a few morphological characters.

**A new *Alternaria* spot of tomatoes in California**, B. DOUGLAS (*Phytopathology*, 12 (1922), No. 3, pp. 146-148, fig. 1).—A description is given of a spotting of tomato fruit that is considered distinct from other forms of tomato diseases previously reported in California. The fungus, which appeared to be distinct from any known species, was isolated, and inoculation experiments proved it was the cause of the spotting. Spotting also occurred on detached leaves of a number of varieties of tomatoes when placed in moist chambers and sprayed with suspension of spores.

**The decay of various vegetables and fruits by different species of *Rhizopus***, L. L. HARTER and J. L. WEIMER (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 50).—A report is given of a study of the susceptibility of 27 different hosts to infection by a number of species of *Rhizopus*. *R. microsporus* and *R. chinensis* infected only a few of the hosts, while *R. tritici*, *R. nodosus*, *R. maydis*, *R. delemar*, *R. oryzae*, and *R. arrhizus* are more vigorous parasites under artificial conditions than *R. nigricans*, *R. reflexus*, *R. microsporus*, and *R. artocarpi*, which represent the low-temperature group. *R. nigricans* is considered the predominating species causing decay of vegetables and fruits in storage and on the market.

**The parasitism of bastard toadflax (*Comandra pallida*)**, D. F. FISHER (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 104).—This plant, in addition to



being parasitic on apple roots, has also been found on the roots of the peach and upon sagebrush, lupine, and yarrow.

**Susceptibility of apple rootstocks to black root rot,** F. D. FROMME (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 54, 55).—Apple trees on seedling roots inoculated with *Xylaria* sp. produced infection and death of three-fourths of the trees within a period of three years. Similar trees on Northern Spy roots were found to be more resistant.

**Origin of apple-blotch cankers,** M. W. GARDNER (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 55).—Observations of blotch (*Phyllosticta solitaria*) on Northwestern Greening in Indiana are said to have shown that a very high percentage of the twig cankers occur at leaf scars, and the crossing over of the fungus from the leaf to the twig was repeatedly noted. Cultural tests, in which the fungus was isolated from petiole segments and leaf scars well below the lower margin of a petiole lesion, are said to indicate that the mycelium may grow down within the petiole and cross the absciss-layer before the leaf falls. Infection through bud scales is also believed to occur.

**European canker in Pacific Coast States,** S. M. ZELLER and C. E. OWENS (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 105).—The European canker of apple caused by *Nectria galligena* has been known in Oregon since 1918, but its wide distribution was not noted until after the extreme low temperatures experienced in December, 1919. The authors report as the hosts for this canker a number of varieties of apples and pears, and in addition it attacks *Quercus garyana*, *Acer macrophyllum*, *A. circinatum*, *Cornus nuttallii*, and *Salix* sp. Attack is said to be extremely virulent on Bosc and Anjou pears, cankers from 20 to 22 in. in length being produced in a single season.

**Third progress report on apple scab and its control in Wisconsin,** G. W. KEITT (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 54).—The first ascospore discharge was observed at Sturgeon Bay on May 13 and the last on June 16. Inoculations on leaves and fruit have shown incubation periods of from 14 to 18 days, and observations covering a number of years and infection experiments have indicated that leaves and fruit of the varieties studied are much more susceptible to scab when young than in later stages of development. The upper surfaces of the leaves ordinarily became highly resistant before they were fully expanded, while the lower surfaces of mature leaves might develop a diffuse, sooty type of infection after a much prolonged incubation period.

**Experiments on the use of oiled fruit wraps for the control of apple scald,** C. BROOKS, J. S. COOLEY, and D. F. FISHER (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 103).—It was found that apple scald could be arrested or reduced after several months' storage by removing the common paper wraps and substituting oiled paper. Likewise if the fruit was first stored in oiled paper scald did not result when it was repacked in common paper after as short a time as one month.

**An outbreak of powdery mildew (*Podosphaera leucotricha*) on pears,** D. F. FISHER (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 103).—The author reports a serious outbreak of powdery mildew on pears in the central Washington fruit districts in 1921. Twig and foliage infection was not general, but the attack was confined to tender water sprouts and terminals. In addition, the fruit was very generally infected, some varieties being seriously injured. The effect of the disease on the fruit is the production of a black or russeted disfiguration and in some cases a distortion of shape somewhat like early scab infection.

**Notes on bacterial gummosis of stone fruits,** J. T. BARRETT (*Abs. in Phytopathology*, 12 (1922), No. 2, pp. 103, 104).—The disease designated as bacte-



rial gummosis caused by *Pseudomonas cerasus* has been under observation in California for a number of years, and it has been found to attack severely the apricot and less severely the cherry, and to cause considerable injury to young peach buds in the nurseries. It is claimed that infection may take place from October to May, but the greatest activity on the apricot was observed from January to April. Preliminary tests indicate that the range of temperature is from 20 to 27° C. (68 to 80.6° F.) for optimum growth of the organism.

**Effect of alkaline sprays on the size of sweet cherries**, D. F. FISHER (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 104).—Spraying experiments carried on in Oregon from 1915 to 1917 are said to have shown that cherries were dwarfed by the use of heavy applications of self-boiled lime sulphur and Bordeaux mixture. The investigation is said to indicate that dwarfing by alkaline sprays is brought about through excessive transpiration or water loss caused by the destruction of the waxy bloom on the fruit.

**The dissemination of peach yellows and little peach**, M. T. COOK (*Phytopathology*, 12 (1922), No. 3, pp. 140-142).—This is a summary of investigations previously noted (*E. S. R.*, 47, p. 249).

**A new peach wilt disease**, C. M. HAENSELER (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 56, 57).—A peach tree wilt disease due to a species of *Verticillium* is reported from New Jersey. Comparisons of the organism *V. alboatrum* from okra and eggplant were made, but no marked morphological or cultural differences were noted.

**The transmission of nematode resistance in the peach**, J. A. McCLINTOCK (*Science*, 58 (1923), No. 1510, pp. 466, 467).—The author gives an account of experiments carried on at the Georgia Experiment Station, in which peach pits from different sources were grown and observations made on their susceptibility to nematode attack. The seedlings grown from Florida pits were practically free from root knots, and the trees produced their first crop of fruit in 1921. Seeds from these fruits were again planted, and a second generation of Florida seedlings was obtained that were also free from root knots.

**Die-back of loganberry in the Northwest**, S. M. ZELLER (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 104).—Die-back of the canes of loganberry is said to have been very prevalent in the Northwest in 1922. The fungus (*Mycosphaerella rubina*) was identified with some of the die-back, but evidence points to the conclusion that the canes were devitalized by the extreme moist conditions to which they were subjected during the winter rather than by the effects of any parasitic organism.

**Leaf curl and mosaic of the cultivated red raspberry**, W. H. RANKIN, J. F. HOCKEY, and J. B. McCURRY (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 58).—The authors claim that these diseases, previously confused under the name yellows, are distinct and easily separable. No causal organism for either disease has been found. Control of mosaic may be secured by roguing in August, while roguing for the control of leaf curl should take place as soon as the bushes leaf out in the spring.

**A preliminary report on the control of raspberry anthracnose**, L. K. JONES (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 57, 58).—Comparative tests of Bordeaux mixture and lime sulphur with and without various adhesives have shown that lime sulphur gives more satisfactory control than Bordeaux mixture.

**Some fig diseases**, E. H. PHILLIPS (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 107).—Fig smut due to a species of *Aspergillus*, *Sclerotinia libertiana* causing die-back, a *Botrytis* also causing die-back, and an undetermined fungus which causes a rot of fig fruits and subsequent cankers on the stems are enumerated.



**Pathogenicity of the olive-knot organism on hosts related to the olive,** C. O. SMITH (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 106).—As a result of extensive inoculation experiments with the organism *Pseudomonas savastanoi*, the author was unable to obtain positive results except on hosts closely related botanically to the olive.

**Banana freckle in the Philippine Islands,** H. A. LEE (*Phytopathology*, 12 (1922), No. 2, pp. 101, 102, fig. 1).—The author reports a black spotting very common upon the banana fruits in the public markets in the Philippines that is believed to be identical with the disease described by Carpenter as due to *Phoma musae* (E. S. R., 41, p. 153.) The common occurrence of banana freckle in the Philippines is believed to corroborate the view that the disease was taken to Hawaii from the Philippines.

**The relation of citrus blast to certain environmental factors,** H. S. FAWCETT (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 107).—The organism (*Bacterium citriputeale*) which is the cause of both citrus blast and black pit is said to be active only in the rainy season during a short period in late winter and early spring. Studies of the occurrence of this disease are said to show that whenever the number of rainy or cloudy days falls below normal the disease is mild or unimportant, and whenever the rainy or cloudy days are above normal the disease is severe.

**Weather and its relation to citrus scab epidemics in Alabama,** G. L. PELTIER and W. J. FREDERICH (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 57).—The authors claim that under Alabama conditions temperatures for optimum infection usually prevail during April and May. The conditions essential for an epidemic of disease are a late season, sufficient moisture, and the development of spring growth at the time optimum temperatures for infection prevail. Under Alabama conditions a light or a bad scab year can be predicted by the monthly mean temperature prevailing during March, a monthly mean temperature below normal being an indication of a bad scab year, while a normal temperature of 59° F., or above, is indicative of a light infection.

**Some notes on two cars of grapefruit from the Isle of Pines,** W. T. HORNE (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 106).—A brief report is given of an inspection of grapefruit made in San Francisco in October, 1917. Among the blemishes noted were rust mite injury, tear stain, melanose, scab, black thrips rings, storage spot, gum spot, Diplodia stem-end rot, Phomopsis stem-end rot, *Myriangium* sp., and *Sphaerostilbe cocophila*.

**A Phomopsis from the Isle of Pines,** W. T. HORNE (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 105).—A report is given of a species of Phomopsis collected from grapefruit in the Isle of Pines, the characters of which did not correspond exactly with *P. citri* described from Florida.

**A Phomopsis of citrus in California,** H. S. FAWCETT (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 107).—A Phomopsis somewhat resembling *P. citri* known in Florida has been observed in Santa Barbara and Los Angeles Counties, Calif.

**Acid and water content of lemon fruits at different stages of development,** E. T. BARTHOLOMEW (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 107).—In connection with the study of the internal decline of lemons, the author each month tested fruits to determine the relative percentages of acidity and water content. The acidity was found to be approximately the same in both ends of the lemons at all stages, and it increased from about pH 4.46 in fruits 0.75 in. in diameter to about pH 2.23 in mature fruits. The water content of the blossom end of the lemon is usually slightly greater than that of the stem end. In lemons 0.75 in. in diameter the water content is about 53 to 55 per cent, while that of mature fruits is about 88 to 90 per cent.



**Internal decline of lemons**, E. T. BARTHOLOMEW (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 106).—A brief description is given of a disease that is due to a physiological disturbance characterized by the breaking down and drying out of the internal tissues, usually at the blossom end of the fruit. It is first noticeable in the inner layers of the white parenchymatous tissue of the rind. From here the disease spreads rather rapidly into the pulpy tissues below and they become dry and light brown in color. Usually the trouble does not appear until the fruit is about ready to pick, but then it may be found in green, silver, or yellow fruits, most commonly in the two latter. As much as 50 per cent of the fruit is sometimes rendered valueless except for the by-products laboratory.

**Some studies relating to infection of and resistance to walnut blight**, *Pseudomonas juglandis*, C. O. SMITH (*Abs. in Phytopathology*, 12 (1922), No. 2, p. 106).—It is claimed that the leaf and catkin buds situated near blight lesions may have the blight organism on their surface before new growth starts. Artificial inoculation on dormant buds develops little or no infection on new growth. Buds advanced so as to show green leaf tissue may be readily inoculated. The catkins themselves become infected, and pollen from such catkins when shaken into Petri dishes with agar develop blight colonies. Soil as a carrier of the organism has been demonstrated, but it could not be cultured or cause infection after about nine days.

**Fusarium rot of gladiolus**, L. M. MASSEY (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 53).—A *Fusarium* rot of gladiolus, the causal organism of which agrees closely with *F. oxysporum*, is reported.

**Chemical injuries to white pines**, W. H. SNELL and N. O. HOWARD (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 59).—Injury to white pines by gases from the chimney of a brickkiln for a distance of 0.25 mile is reported. In addition, the death of white pine trees along the roadside in New Hampshire was found due to the storage of barrels of calcium chlorid under the trees, some of the salt having seeped into the soil.

**The occurrence and development of pathological resin canals in the Coniferae**, A. S. RHOADS (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 59, 60).—A study has been made of the occurrence of pathological resin canal formations. It was found that they may be induced by injuries to the cambium resulting from all kinds of mechanical wounding, attacks by various parasitic fungi and mistletoes, and abnormal physiological conditions of growth and nutrition.

**Experiments in the infection of *Pinus strobus* with *Cronartium ribicola***, H. H. YORK and W. H. SNELL (*Phytopathology*, 12 (1922), No. 3, pp. 148–150).—A preliminary account is given of inoculation experiments in which 500 potted seedlings of *P. strobus* were inoculated with freshly developed telia from cultivated *Ribes nigrum*. Infection was found to occur within 12.5 hours after the viable sporidia of *C. ribicola* reached the needles of seedlings of *P. strobus* under conditions of the experiments.

**Two important pine cone rusts and their new cronartial stages** (*Phytopathology*, 12 (1922), No. 3, pp. 109–122, pls. 2).—*Cronartium strobilinum* on *Pinus heterophylla* and *P. palustris* with its cronartial stage on *Quercus geminata*, *Q. virginiana*, and *Q. nigra* is described by G. G. Hedgcock and G. G. Hahn, and *C. conigenum* on *P. chihuahuana* with its cronartial form on *Q. emoryi* and *Q. hypoleuca* by Hedgcock and N. R. Hunt.

Both fungi have been transferred to other species of oaks by inoculation.

**Records for four years on the needle blight of *Pinus strobus***, J. H. FAULL (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 58, 59).—The author reports that needle blight of white pine, which has been frequently reported,

is associated with the killing of the roots. This is apparently due to a combination of soil peculiarities and drought conditions, the root system not being able to supply the sudden demand for water made by the new foliage.

**Hypoxylon poplar canker**, A. H. W. POVAH (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 59).—This canker of poplar trees is said to have occurred in New York, Michigan, and Maine. Often the tree is girdled, which results in the death of the whole upper part. A survey of a sample plat in Essex County, N. Y., showed 37 per cent of the trees of *Populus tremuloides* infected and 27 per cent of them killed by the disease.

**Helminthosporium heveae in Sumatra**, C. D. LARUE (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 60).—The author reports observing this fungus on old trees on numerous rubber estates in Sumatra in 1919.

**The effect of heat upon the mycelium of certain structural timber destroying fungi within wood**, W. H. SNELL (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 59).—A study made of spruce blocks infected by a number of wood-rotting fungi showed that heating structures affected with decay to from 47 to 48° C., as has been suggested, would not kill the fungi even in moist cotton weave sheds, although the drying effect would be beneficial in certain types of structures.

**Pulp storage in water**, R. J. BLAIR (*Abs. in Phytopathology*, 12 (1922), No. 1, p. 60).—It is claimed that storing ground wood pulp in water will protect it from fungus attack much better than when the pulp is piled in sheds and allowed to dry out.

**The stem and bulb infesting nematode in America**, G. H. GODFREY (*Abs. in Phytopathology*, 12 (1922), No. 1, pp. 52, 53).—The occurrence of *Tylenchus dipsaci* is reported in America on red clover, alfalfa, and strawberry in Oregon and Idaho and on daffodils in a bulb garden in Chicago.

### ECONOMIC ZOOLOGY—ENTOMOLOGY.

**Western birds**, H. W. MYERS (*New York: Macmillan Co., 1922, pp. XII+391, pls. 45*).—In this work the author deals with the song birds of the States bordering the western coast and, to a lesser degree, the interior Western States.

**Birds of West Virginia: Their economic value and aesthetic beauty**, I. H. JOHNSTON (*Charleston, W. Va.: State Dept. Agr., 1923, pp. 138, pls. 2, figs. 57*).—This work presents summarized accounts of the birds of West Virginia with illustrations of 40 in colors.

**Food and economic relations of North America grebes**, A. WETMORE (*U. S. Dept. Agr. Bul. 1196 (1924), pp. 24, figs. 4*).—It is pointed out that a knowledge of the feeding habits and general economic status of the species of grebes inhabiting the different sections of the United States is of importance in connection with the relations of these birds to the supply of food fishes. Grebes, living in ponds, lakes, and watercourses, have at times been suspected of being seriously detrimental to the continuance of certain valuable fishes, but it has been ascertained in the investigations here reported that this suspicion is without actual foundation in fact. The bulletin reports upon the distribution, food, and economic status of six grebes found in the United States, namely, the western grebe (*Acchmophorus occidentalis*), Holboell grebe (*Colymbus holboelli*), horned grebe (*C. auritus*), eared grebe (*C. nigricollis californicus*), Mexican grebe (*C. dominicus brachypterus*), and the pied-billed grebe (*Podilymbus podiceps*.)

**Nineteenth report State entomologist of Minnesota**, A. G. RUGGLES (*Minn. State Ent. Rpt., 19 (1921-1922), pp. 151, figs. 30*).—This report, covering the biennial period ended December 1, 1922, presents insect notes for that period



(pp. 3-9); Preliminary Notes on the Life History and Control of the Potato Leafhopper (*Empoasca mali* LeB.), by Ruggles and J. R. Eyer (pp. 10-14); The Red Turpentine Beetle in Itasca Park (pp. 15-21) and Effect of Physical Factors in the Ecology of Certain Insects in Logs (pp. 22-40), both by S. A. Graham; Derris as a Parasiticide, by P. M. Gilmer (pp. 41-49); Studies on the Life History and Biology of *Perillus bioculatus* Fab., Including Observations on the Nature of the Color Pattern, by H. H. Knight (pp. 50-96); Preliminary Notes on the Mutillidae of Minnesota with Descriptions of Three New Species, by C. E. Mickel (pp. 97-113); and A Synoptical Key to the Aphididae of Minnesota, by O. W. Oestlund (pp. 114-151).

**Guide to the insects of Connecticut.—IV, The Hemiptera or sucking insects of Connecticut,** W. E. BRITTON ET AL. (*Conn. State Geol. and Nat. Hist. Survey Bul.* 34 (1923), pp. 807, pls. 20, figs. 169).—This fourth part of the work (E. S. R., 37, p. 765) gives tables for the identification and descriptive accounts of the Hemiptera known or supposed to occur in Connecticut. Of 1,646 species and varieties listed, representing 486 genera, 872 are recorded from the State. Descriptions of 127 forms new to science are included. The bulletin was prepared under the direction of Britton with the cooperation of J. F. Abbott, A. C. Baker, H. G. Barber, W. T. Davis, D. M. DeLong, W. D. Funkhouser, H. H. Knight, A. C. Maxson, H. Osborn, H. M. Parshley, E. M. Patch, L. A. Stearns, J. R. de la Torre-Bueno, E. P. Van Duzee, and H. F. Wilson.

**Observations on the life histories of the cotton stainer bugs of the genus *Dysdercus* and on their economic importance in the Southern Provinces of Nigeria,** A. W. J. POMEROY and F. D. GOLDING (*Nigeria Agr. Dept. Ann. Bul.* 2 (1923), pp. 23-58).—This is a report of studies of the life history and habits of *D. supersticiosus* Fab. and of natural enemies and control measures. Much of the data is presented in tabular form.

**The three-banded grape leafhopper and other leafhoppers injuring grapes,** G. A. RUNNER and C. I. BLISS (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 9, pp. 419-424, pls. 2).—This is a preliminary report of studies commenced in 1919 of the leafhopper fauna on grape, which has covered localities extending from the Hudson River Valley section to the Lake Michigan grape belt, and particularly the Sandusky, Ohio, region. Most of the hoppers occurring in this region belong to the genus *Erythroneura*, of which seven forms are mentioned, the three-banded grape leafhopper (*E. tricineta cymbium* McA.) being the most common and injurious form in commercial grape-growing regions west of Cleveland. This form in the regions of its greatest abundance comprises a larger proportion of the hopper population on thick-leaved grapes such as Concord and Catawba than on thin-leaved grapes such as Delaware, Clinton, and wild *Vitis vulpina*.

"Other varieties of *E. tricineta*, notably *tricincta* Fitch and *calycula* McAtee, show exactly the opposite habit, occurring rather commonly on wild *V. vulpina*, Clinton, and other thin-leaved cultivated grapes, but being practically absent from varieties such as Concord and Catawba. Varieties *tricincta* and *calycula*, in both of which the anterior crossband overlaps the base of the scutellum, intergrade; are very much more widely distributed geographically than *cymbium*, with known range including Connecticut, Tennessee, and Kansas; and occur in much smaller numbers than *cymbium*. This ecological difference between *cymbium* and *tricincta-calycula* explains the apparent contradiction between our results and those reported by Hartzell in 1912" (E. S. R., 27, p. 157).

The three-banded grape leafhopper caused severe injury in 1920 and was about as numerous and destructive in 1921 and 1922. Notes are given on its



distribution, life history and seasonal history, and control measures, with a description of the adult. Control experiments with several of the species occurring in northern Ohio vineyard districts are said to have given results not significantly different from those reported by previous workers. Spraying was not effective against adults, but must be directed against the nymphs. A nicotin spray at a strength of 1 to 1,200 thoroughly applied to the under surface of the leaves when the nymphs have nearly completed their growth has been recommended and is said to reduce infestation sufficiently to permit normal development and ripening of the fruit and wood.

**Studies in North American Delphacidae (Homoptera)**, F. MUIR and W. M. GIFFARD (*Hawaii. Sugar Planters' Sta., Ent. Ser. Bul. 15 (1924), pp. 53, figs. 136*).—This paper deals mainly with the North American species of Delphacidae (formerly of the family Fulgoridae) of the genus *Delphacodes*, together with some allied species. A table of the genera and notes on the species listed by Crawford under *Megamelus* are included. A new genus is erected, 49 species of the genus *Delphacodes* are recognized, of which 15 are described as new to science, and of the allied species 4 are described as new.

**Eastern spruce budworms in the West**, J. C. EVENDEN (*Timberman, 25 (1923), No. 2, pp. 53, 54, figs. 3*).—After calling attention to the serious damage caused by *Cacoecia fumiferana* to balsam and spruce in the north woods of Maine and Canada since 1910, the author reports upon its appearance in Idaho in 1922. Since that time it is said to have been found to be established in the Yellowstone National Park and on the Payette and Little Salmon Rivers in Idaho.

"In the Yellowstone National Park, where the epidemic has been in progress for at least five years, a large volume of Douglas fir and Engelmann spruce has been killed. This loss varies in different parts of the region infested, from a very small percentage to a 75-per cent kill on 50 to 100 acres or more. In Idaho, where the outbreaks have been in progress for only two or three years, there has been but very little timber actually killed. The following host plants have been recorded for this insect in the West: Grand or white fir, Douglas fir, Engelmann spruce, western larch, western hemlock, white pine, yellow pine, lodgepole pine, and western cedar."

**The rice borer (*Schoenobius incertellus* Wlk.)**, A. A. ROWAN (*Philippine Agr., 12 (1923), No. 6, pp. 225-236, pl. 1*).—This pyralid is said to be one of the worst enemies of rice in the Philippine Islands, occurring as it does all over the archipelago. It has been reported to be a pest in almost all rice-growing regions in the Orient, notably Taiwan, where studies have been conducted by Shiraki (*E. S. R., 42, p. 55*), Japan, India, the Dutch East Indies, French Indo China, Federated Malay States, and Ceylon. Its work is characterized by a total whitening of the entire panicle, including a large part of the contiguous more distal portion of the stalk.

"The moth lays its eggs in a mass on the upper surface of the rice leaf at a distance of about 12 cm. from the tip. The number of eggs present in each mass varies from 36 to 96. The newly hatched larvæ bore into the stalk and eat up the tender part, thus severing the more distal from the lower portion of the plant and inhibiting the formation of grains. As many as 12 young larvæ may be found feeding in one stalk, although there is usually one to each stalk in the case of more fully grown larvæ. The larvæ migrate to another plant after the food in the host is consumed. The larva ceases feeding one or two days before each molt. Feeding is resumed generally 12 hours after the process. Pupation takes place at the lower part of the stalk, at a distance of from 10 to 15 and occasionally 30 cm., or higher, above the surface of the ground.



"The moths are active at night, beginning at sundown and ending at sunrise. The adult insects are attracted to light. It is interesting to note that most of the individuals collected by lamplight in the present work were females. During the day the insects hide among the grass or among the thick growth of rice.

"The life history varies from 84 to 90 days. The period of incubation varies from 8 to 9 days, the larval stage from 60 to 66 days, the pupal from 9 to 12 days, and the adult from 3 to 7 days. The total length of the immature stage varies from 80 to 85 days. The insect apparently passes a period of aestivation in rice stubbles in the form of larvæ and pupæ during the months of March, April, May, and the early part of June, and becomes abundant during the months of September and October, January, and the earlier part of February.

"The eggs are parasitized by certain ichneumonid and chalcid parasites which lay their eggs on the egg mass of the moth. Among the predators of the larvae are certain species of ants, praying mantis, spiders, frogs, centipedes, and birds. A considerable percentage of the larvae has been found to die from the attack of a certain fungus disease. The adults are attacked by birds, certain species of spiders, frogs, mantids, and dalag (*Ophiocephalus striatus* Bloch). The damage on rice in the College of Agriculture during the year 1922 varied from 0.8 to 32.3 per cent. Different varieties of rice show different degree of susceptibility to the attack of the pest. Fields with grassy surroundings and with stubble left after harvest appear to be more susceptible to the heavy attack of *Schoenobius* than the cleaner ones. Spacing has practically no effect on the degree of infestation."

A list is given of 13 references to the literature.

**Observations on the relations between atmospheric conditions and the behavior of mosquitoes,** W. RUDOLFS (*New Jersey Stat. Bul.* 388 (1923), pp. 5-32, figs. 6).—This is a report of investigations conducted during August, September, and October, 1921, and June and July, 1922, with females of *Aedes sollicitans* and *A. cantator* in the salt marshes near the coast of New Jersey and near an isolated dwelling surrounded by salt marshes and woodland at Barnegat, N. J. It was found that the activity of mosquitoes increases with the increase in temperature unless the temperature becomes too high.

"Activity decreases rapidly below 60° F. and stops almost entirely below 50°. A temperature between 68 and 77° has the greatest accelerating influence upon the rate of their activities. . . . The influence of wind upon the rate of alighting becomes apparent with a wind velocity between 4 and 8 miles an hour, while the rate of alighting with a wind velocity above 8 miles an hour is constant in spite of increasing temperature, so that wind velocity overcomes the influence of temperature. The number of mosquitoes alighting increases in almost linear fashion with the increase of relative humidity up to 85 per cent; from 85 to 95 per cent relative humidity the numbers alighting remain nearly constant. The percentage caught of those alighting, which indicates degree of general activity, increases rapidly with the relative humidities below 75 per cent; it remains constant from 75 to 85 per cent relative humidity and decreases slowly from 85 to 95 per cent relative humidity.

"Extremely high humidities are detrimental to the general activities of the insects. Higher light intensities seem to stimulate the activities of these species of mosquitoes. Previous precipitation seems to influence the vigor of biting and troublesomeness of these species of mosquitoes. Prolonged showers and heavy rainfall decrease the numbers of mosquitoes on the wing. It is indicated that high temperatures and low relative humidities tend to increase attractiveness of persons subject to the attack of mosquitoes."



**The natural history of mosquitoes of France**, E. SÉGUY (*Histoire Naturelle des Moustiques de France*. Paris: Paul Lechevalier, 1923, pp. [4]+225, figs. 201).—This is a small handbook on the classification and biology of mosquitoes of central and northern Europe and their parasites. A bibliography of nine pages is included.

**Some observations on the winter activities of Anopheles in southern United States**, M. A. BARBER, W. H. W. KOMP, and T. B. HAYNE (*Pub. Health Rpts. [U. S.]*, 39 (1924), No. 6, pp. 231-246).—The studies reported have shown that in the southern portions of Georgia, Alabama, and Louisiana the larvae of *Anopheles* may be found in large numbers in winter, and that the development of ova, larvae, and pupae continues in winter as in summer, but more slowly.

"Winter-breeding *Anopheles* may supplement overwintering adults in the production of the spring supply, and any winter attack on *Anopheles* must be directed against larvae as well as against adults. Aquatic stages of all of the three common species of *Anopheles* [*A. crucians*, *A. punctipennis*, and *A. quadrimaculatus*] occur in winter; those of *A. quadrimaculatus* are the least plentiful. The activities of adults continue in the winter, and there is no true hibernation of any species. Adults are widely dispersed, and no means of destroying them in winter is likely to succeed unless some efficient means is devised of attracting them to places where they can be successfully attacked."

**Study of the Colorado potato beetle (*Leptinotarsa decemlineata* Say) and means for its eradication**, J. FEYTAUD (*Min. Agr. [France]*, *Ann. Épiphyties*, 9 (1923), No. 4, pp. 209-306, pl. 1, figs. 22).—This work brings together the author's studies of the Colorado potato beetle, particularly observations made during 1922 and information noted from another source (*E. S. R.*, 50, p. 661).

**Life history and control of the Mexican bean beetle**, F. L. THOMAS (*Alabama Sta. Bul.* 221 (1924), pp. 99, figs. 27).—This is an extended report of investigations of *Epilachna corrupta* Muls. conducted in Alabama in 1921 and 1922 in cooperation with the U. S. D. A. Bureau of Entomology. Earlier accounts of work in Alabama have been noted (*E. S. R.*, 45, p. 158). Following an introductory discussion, the author deals with its synonymy, history in Alabama, distribution and spread, food plants, the character and extent of its injury, and descriptions of its several stages. An extended account is given of its life history and habits. Its natural control is briefly considered, mention is made of the insects mistaken for it, and preventive and control measures are dealt with. Much of the data is presented in tabular form.

The author finds that this bean beetle can be controlled economically by dusting the foliage of the beans, several insecticides having been used with success. The formula recommended contains  $\text{As}_2\text{O}_3$  6.66 per cent and consists of calcium arsenate (high grade) 16.66 per cent, fine dusting sulphur 16.66 per cent, and hydrated lime 66.66 per cent.

"Green beans dusted with this insecticide are perfectly safe to be used as food, but washing is advised. It is recommended that applications of insecticides be made when the foliage is dry and when little wind is blowing. Four or five applications will usually be sufficient for protecting early planted bush varieties of snap or string beans. Those coming up about the middle of April should receive their first application in two or three weeks. The time of the first treatment for later plantings varies according to the infestation. Ordinarily it should begin soon after beetles are found, especially on beans planted after May.

"Applications to bush varieties should be made once each week, for if the infestation is once allowed to become abundant a certain amount of injury will result. Five applications, beginning the first week in May, provided good



protection for early planted pole beans until the last of June. Control is more easily obtained on butter beans than on snap beans. Treatment every 10 days beginning the middle or last of May will be found amply sufficient to protect early planted butter beans.

"The foliage of butter beans, *Phaseolus lunatus*, is more susceptible than that of snap beans, *P. vulgaris*, to injury from the use of insecticides. Mature beans which have been well protected appear to be less attractive to the Mexican bean beetle and require very little in the way of treatment.

"When dusting pole beans, the dust cloud may become thick around the operator. Sometimes it is necessary to wear a handkerchief over the lower part of the face and tied behind the head.

"If cowpeas are being grown for seed and the vines become infested any of the insecticides recommended for use on beans will reduce the infestation and save the vines if applied in time. To facilitate the application of such treatments the cowpeas should be planted so that a skip occurs every fifth row, or if sown broadcast so that a space wide enough to walk is left between 'beds' not over 12 ft. in width. If cowpeas to be fed as hay to livestock are in danger from the beetle as a result of destroyed bean plantings, immediate cutting is advised."

A bibliography of 33 titles is included.

**The squash ladybird beetle**, G. W. UNDERHILL (*Virginia Sta. Bul.* 232 (1923), pp. 24, figs. 17).—This is a brief report of two years' work in the laboratory and field on the life history and habits of *Epilachna borealis*, especially as a melon pest in Virginia. This insect is found throughout the State, being especially severe where melons are grown commercially.

The first and second brood beetles overwinter in clusters, mainly on the lower portion of tree trunks and to a less extent under leaves and trash on the ground. They emerge from winter quarters and begin to infest melon fields in late May and early June. After feeding about two weeks they deposit their eggs in clusters on the underside of the leaves. In 1920 and 1921 an average of 43 eggs per cluster was deposited, the first about June 10 to 15, the maximum numbers occurring in the fields in July and early August. The average incubation period of the egg is 7.21 days, for the larva 18.3, and for the pupa 7.04 days. There are two broods each year, and in 1921 a third brood developed in the insectary.

The experiments indicate that the melon beetle can be controlled by field spraying and dusting, although field tests have not been entirely satisfactory. Zinc arsenite has proved in all tests to be the best poison, with calcium arsenate a close second.

**The sweet potato weevil**, H. J. REINHARD (*Texas Sta. Bul.* 308 (1923), pp. 7-90, figs. 5).—This is a report of investigations commenced in January, 1918, and continued until April, 1920. Following an introductory account, the author deals at length with studies of the biology of this pest and its natural and artificial control. A large part of the data is presented in tabular form.

The insect is widely distributed in Texas, where all varieties of sweet potato are attacked by it, the annual loss resulting from its ravages being very great. "The average life cycle comprises 35 to 40 days under favorable conditions. More than 500 eggs may be deposited by the female weevil, although the average number is considerably less. The length of adult life is often protracted and may extend upwards of 300 days. In stored tubers feeding and breeding may be continued throughout the year. Under laboratory conditions eight generations of weevils were obtained in a year. The sweet potato weevil does not enter into a definite period of hibernation at College Station.



"There were no parasites or predacious enemies observed that are of economic importance. Artificial measures of control must be used in combating this pest. Crop rotation and clean culture are important features in controlling the insect. Remedial measures consist of (1) spraying with arsenicals, (2) the use of weevil-free propagation plants, (3) prompt and thorough harvesting, (4) fumigation with carbon bisulphid, and (5) proper storage."

A list is given of 16 references to the literature cited and a bibliography of 11 pages. Investigations of this pest by Graf and Boyden have been noted (E. S. R., 46, p. 462).

**The strawberry crown borer in Tennessee**, S. MARCOVITCH (*Tennessee Sta. Bul.* 128 (1923), pp. 21-53, figs. 8).—This is a report of studies of the biology and control of *Tyloderma fragariae* Ril. in Tennessee, much of the data being presented in tabular form. This curculionid beetle has become very abundant in certain localities in Tennessee. In addition to the strawberry, which is the only cultivated plant known to be infested by it, the adults have, under experimental conditions, oviposited on the Indian strawberry (*Duchesnia indica*) and fivefinger (*Potentilla pumila*), from which adults were later reared. An average of 95.3 eggs are deposited, which hatch in from 7 to 29 days, and the larvae crawl inside the crown of the strawberry and devour the contents. The larval stage was found to vary from 24 to 54 days and the pupal stage from 6 to 17 days.

"In a normal year, the adult beetles make their appearance and become actively engaged in ovipositing about the first week in April. This period usually coincides with the beginning of the flowering of the strawberry. Egg laying continues to the end of September, while larvae may be present from April to the last of November. Hibernation takes place in the adult stage in the strawberry patch beneath leaves and rubbish. The strawberry crown borer is almost free from natural enemies. Two hymenopterous larvae were obtained from two adult beetles on March 7, but these were not reared. The life cycle is generally believed to be one year. During the course of this investigation several females lived through the winter, after ovipositing in the preceding summer, and continued to oviposit the following spring."

In the discussion of control measures it is pointed out that plowing under an infested patch of strawberries may not destroy the adults, particularly if the soil is dry. The greatest precaution should be taken to secure plants from uninfested patches, for the pest is unable to spread by flight as it possesses only very small vestigial wings.

**A progress report of boll weevil poisoning work at the Holly Springs Branch Experiment Station**, C. T. AMES (*Mississippi Sta. Circ.* 51 (1923), pp. 11).—This is a preliminary report of tests made of the different methods of application of calcium arsenate, conducted at the substation in 1923. In the investigations the system worked out by the U. S. D. A. Bureau of Entomology (E. S. R., 47, p. 163) and the so-called Florida method, as described by Smith (E. S. R., 48, p. 254), were tested, the object being to determine if the hill section of the State can continue to grow cotton profitably.

It is pointed out that the average date of the first squares anywhere in Mississippi is around the last of May, and at Holly Springs Station the earliest cotton, planted April 24, began squaring June 16, at which time 76.2 per cent of the weevils were out of hibernation. At the time of the first poisoning, June 20, 91.2 per cent were out of hibernation. Only six days were required at Holly Springs to bring out the remainder of the 100 per cent after the first poisoning of the earliest planted cotton. The records show that 762 weevils per acre entered the plat.



In a first early poisoning test, applications of a commercial preparation, molasses calcium arsenate, and dust calcium arsenate, were made June 26, the date of total emergence of the weevils, at which time the squares had begun to form, and on July 2, 12, and 18, respectively, on cotton planted May 8. In this test the yield of seed cotton from the commercial preparation plat was 1,212 lbs. (profit \$46.50), from the molasses calcium arsenate plat 1,116 lbs. (profit \$38.36), and from the dust calcium arsenate plat 1,000 lbs. (profit \$25.98), while the yield on the check plat was 717 lbs. In the second early poisoning test applications of dust calcium arsenate were made with a dusting machine on July 2, 6, 10, 18, and 24, respectively, on cotton planted May 7. In this second test 833 lbs. of seed cotton were obtained, with a profit of \$54.79, from the plat where the dust calcium arsenate was applied and only 300 lbs. from the check plat.

The results of poisoning in the first test are considered to justify the conclusion that either form of poison when applied in the bud of cotton at the proper time will kill the weevils, and that there is no advantage in favor of either form except in the expense of application. The results obtained in the second test emphasize the importance of applying the poison before square formation has advanced. The first application is said to have destroyed all the weevils in the plat at the time.

In the late poisoning test on cotton planted May 8, in which applications of dust calcium arsenate were made on July 18 and 24 and August 2 and 14, respectively, a yield of 631 lbs. of seed cotton was obtained, with a profit of \$9.17, as compared with a yield of 500 lbs. from the check plat. The first application reduced the percentage of infestation from 16 to 4.5 per cent. The four applications were made with profit, but a too heavy infestation was permitted before the first application was made.

In the comparative test of the Florida method with the early poisoning method, the squares were stripped off 8 days after the poison was first applied, all the weevils having been out of hibernation at the date of application. "On June 20, the time when the first squares began to form, there was an estimated 150 weevils per acre in the cotton. On that date a commercial mixture composed of molasses, calcium arsenate, water, and a secret ingredient said to attract the weevil was applied to the bud of the cotton with a mop. A second application was applied July 2. This second application appeared to have been lost as there was a zero infestation on that date. No other applications of poison were made. On July 31 this field showed 9 per cent infestation. The yield of seed cotton per acre was 1,486 lbs. [profit not stated]." A comparative test of early and late poisoning with calcium arsenate dust, reported upon in tabular form, shows a yield of 1,173 lbs. with a profit of \$32.27 for the former and 1,126 lbs. with a profit of \$26.53 for the latter.

The results obtained have led to the recommendation that in Mississippi cotton be planted between April 25 and May 10, using only early maturing varieties; that cotton valley land be planted on 3.5-ft. rows and thinned to 2 or 3 stalks, left in bunches, per foot; on thin or hill land 3-ft. rows be made and thinned to 3 or 4 stalks, left in bunches, per foot; and that certain fertilizers be used. The poisoning of cotton should commence just as the squares begin to form, and, if labor is plentiful, the molasses calcium arsenate mixture should be applied to the top bud with a mop in the proportion of 1 lb. of calcium arsenate, 1 gal. blackstrap molasses, and 1 gal. of water. Where labor is scarce the author recommends the use of calcium arsenate dust applied in the bud with a dusting machine. "In about 10 days from the time of the first application of poison, a second application of calcium arsenate dust should be made by the use of a machine. On the hill lands these



two applications may be sufficient, but on valley lands or lands where cotton grows more rank, if the infestation reaches 10 per cent, a third application of calcium arsenate dust should be made."

**Practical bee anatomy, with notes on the embryology, metamorphoses, and physiology of the honeybee**, A. D. BETTS (*Benson, Eng.: Apis Club, 1923*, pp. 76, pls. 12).—This small handbook on bee anatomy includes bibliographies of 42 and 24 titles.

**Tick paralysis**, W. P. MACARTHUR (*Jour. Roy. Army Med. Corps, 41 (1923), No. 2, pp. 81-86*).—This is a summary of information on the paralysis caused by *Dermacentor venustus* Banks.

**Our only common North American chigger, its distribution and nomenclature**, H. E. EWING (*Jour. Agr. Research [U. S.], 26 (1923), No. 95 pp. 401-403*).—The author finds that the common species of chigger in the United States is no other than the well-known Mexican chigger *Trombicula tlalzahuatl* of Murray. He suggests the use of the common name North American chigger, as it far exceeds all others in importance and is the only one attacking man and the domestic animals that is distributed over a large portion of the continent. A list is given of localities and hosts from which this species has been identified by the author.

**Acarine disease in Switzerland**, O. MORGENTHALER (*Bee World, 5 (1924), No. 8, pp. 118-120*).—This is an account of the occurrence of *Acarapis woodi* in Switzerland, where it has not thus far spread so devastatingly as in Great Britain. Single apiaries are mostly attacked, and only rarely has the disease spread to three or four apiaries in the same village. The disease appears to have occurred in that country since 1915 or even earlier.

## FOODS—HUMAN NUTRITION.

**Nutrition and clinical dietetics**, H. S. CARTER, P. E. HOWE, and H. H. MASON (*Philadelphia: Lea & Febiger, 1923, 3. ed., rev., pp. XX+17-731, figs. 8*).—In this revision of the volume previously noted (E. S. R., 39, p. 567), the chapters on vitamins and rickets have been rewritten and other sections have been enlarged to include the results of recent investigations.

**Food values and body needs shown graphically**, E. A. WINSLOW (*U. S. Dept. Agr., Farmers' Bul. 1383 [1923], pp. II+36, figs. 50*).—This is a revision of Bulletin 975 (E. S. R., 46, p. 465), with an added table of the vitamin values of many of the foods discussed.

**Red discoloration (so-called "pink" or "pink eye") on dried salted fish**, P. C. CLOAKE ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd., Spec. Rpt. 18 (1923), pp. [5]+23, figs. 4*).—The literature on the development of the discoloration called "pink" in salted fish is reviewed, and a study of the nature of the discoloration is reported.

The present study has led to the conclusion that the color is due to two organisms, a red coccus and an unidentified organism to which the name X is temporarily given. Both of these organisms grow only in the presence of over 15 per cent of salt. Both grow very slowly at ordinary temperatures, the optimum temperature being 99° F. The new organism has the further property of being unstable in dilute solutions of brine. It is considered that the source of contamination is the sea salt used in salting the fish. The method of prevention recommended is the sterilization of the salt, the utensils, and the rooms in which the salting is done. Drying the fish still further also prevents the growth of these organisms, but as is shown in an appendix by T. Moran and J. Piqué, the capacity of the salted fish for reabsorbing water is lost when the drying is excessive.



**Mold growths upon cold store meat**, F. T. BROOKS and C. G. HANSFORD ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd. Spec. Rpt. 17* (1923), pp. IV+142, figs. 10; also in *Brit. Mycol. Soc. Trans.*, 8 (1923), pt. 3, pp. 113-142, figs. 10).—This report supplements a previous one on the black spot of chilled and frozen meat (*E. S. R.*, 46, p. 860) by describing other molds which were found during the course of the work. These include two new species, *Sporotrichum carnis* and *Torula botryoides*, and the type species of a new genus, *Wardomyces anomala*, as well as three species of *Mucor*, two of *Penicillium*, and pink and white yeasts. A detailed description is given of the new species discovered and of different forms of *Cladosporium*, the mold causing black spot.

As was shown to be the case with *Cladosporium*, the molds grow only superficially and do not confer poisonous properties on the meat. The source of these molds is thought to be vegetable debris and animal excreta occurring in the vicinity of abattoirs. "Air-borne spores alight upon the carcasses before and during storage, and develop into mold growths at favorable opportunities. By controlling the temperature and humidity conditions in the cold stores, and by avoiding unduly prolonged storage, the growth of these fungi can be prevented."

A list of 18 literature references is appended.

**The solubility of the metals of cooking utensils in foods**, K. K. JÄRVINEN (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 45 (1923), No. 4, pp. 190, 191).—Data are reported on the amount of metal dissolved from various cooking utensils by boiling in them for 3 hours 1 kg. of a 40 per cent sugar-containing fruit juice of 1.5 per cent acidity and the same amount of a 5 per cent sodium chlorid solution. Average values obtained with the two solutions were as follows: From an iron kettle 1,400 mg. of iron in the sweetened fruit juice and 104 mg. in the salt solution, from an untinned copper kettle 65 and 70 mg. of copper, from tinned copper 27 and 7 mg. of tin, from a nickel kettle 76 and 4 mg. of nickel, from aluminum 120 and 9 mg. of aluminum, and from a brass kettle 0.5 and 1.2 mg. of copper and 2.1 and 2 mg. of zinc, respectively.

**The effect of purification of casein on its food value**, C. FUNK, J. B. PATON, and L. FREEDMAN (*Jour. Metabolic Research*, 3 (1923), No. 1, pp. 1-11, figs. 4).—The authors have attempted further to purify casein from adhering vitamins by adding an oxidizing agent, hydrogen peroxid, to the solution of sodium caseinate before shaking with fuller's earth as described in previous studies by Freedman and Funk (*E. S. R.*, 48, p. 559).

The casein as thus purified lost considerably in its nutritive value for rats, as shown by a comparison with untreated casein. Attempts to correct the deficiency by the addition of the activated fuller's earth obtained from the casein or by materials furnishing vitamins B and C were unsuccessful. In the discussion preceding the report of the experimental studies, the possible presence in crude casein of a new vitamin-like substance which may play a rôle in preventing pellagra is suggested indirectly.

**Digestion of cellulose by the intestinal flora of man**, Y. KHOUVINE (*Ann. Inst. Pasteur*, 37 (1923), No. 8, pp. 711-752, figs. 8).—The author has succeeded in isolating from 36 out of 60 samples of human feces a microorganism of strictly anaerobic type capable of dissolving cellulose. The organism, to which the name *Bacillus cellulosa dissolvens* has been given, is exceedingly difficult to cultivate. It grows normally only in media containing nitrogen in highly disintegrated substances such as fecal material. It is very resistant to heat. Its spores are killed only after boiling for 45 or 50 minutes, and resist the action of saturated chloropicrin for 10 days. Among the products of decomposition of the cellulose by the action of this organism have been found carbon dioxid,



hydrogen, ethyl alcohol, acetic and butyric acids, and a yellow pigment, the total representing only about 60 per cent of the original cellulose. There have also been detected traces of lactic acid, hydrolysis products precipitable by alcohol, and sugars soluble in alcohol.

**Experiments on the utilization of the calcium of almonds by man, M. S. ROSE and G. MACLEOD** (*Jour. Biol. Chem.*, 57 (1923), No. 1, pp. 305-315).—The general plan of the experiments reported is similar to that of an earlier study of the utilization of the calcium of carrots (*E. S. R.*, 42, p. 760). Calcium balances were determined for 12 healthy young women during an experimental period of 15 days, the analyses being made in 3-day periods. The almonds were blanched, air-dried, finely ground, made into wafers with white of egg, and baked. The total diet consisted of almonds, apples, lean beef, butter, crackers, egg white, sugar, and in 2 cases coffee. The proportion of the calcium derived from the almonds varied from 73 to 86 per cent. Three additional experiments were also conducted on the utilization of the calcium of milk. In these equilibrium was practically established on from 6 to 7 mg. of calcium per kilogram of body weight.

In the experiments in which about 73 per cent of the calcium of the diet was derived from almonds, there was a daily output of from 5 to 6 mg. of calcium per kilogram of body weight on an intake of 4.1 mg. These figures correspond to those obtained when milk furnished about the same proportion, 70 per cent, or when carrots furnished from 55 to 85 per cent of the total calcium. When the almonds furnished from 85 to 86 per cent of the calcium, the amount necessary for equilibrium was increased from 8 to 12 mg. per kilogram. These results are similar to those reported by Blatherwick and Long for the calcium utilization of mixed vegetables (*E. S. R.*, 47, p. 763).

In a separate investigation of the digestibility of almonds, the coefficients of digestibility of the protein and fat were found to be 83.3 and 91.1, respectively. The ratio between urinary and fecal calcium ranged from 1:6.9 to 1:34.6, the latter occurring in the case in which there was the greatest storage of calcium. "On the whole it would appear that almonds contribute efficiently to the calcium of the diet, but when a very high proportion of the calcium comes from almonds the conditions in the digestive tract may not be quite so favorable for economical utilization as when carrots or milk form the main source of the calcium."

**The value of calcium in the diet, H. S. MITCHELL** (*Amer. Food Jour.*, 18 (1923), No. 10, pp. 463-465, figs. 3).—This discussion of the value of calcium in the dietary contains a list of the common foods, with their content in calcium in grams per ounce, and two typical menus, one furnishing less than half and the other more than twice the daily calcium requirement for an adult. Photographs are included of two rats of the same age, one of which had been fed on a diet low and the other on a diet high in calcium. Photographs are also given of the skeletons of these rats, and X-ray photographs of two others at the end of five weeks on diets rich and poor in calcium.

**Methods of determining malnutrition, S. J. BAKER and J. L. BLUMENTHAL** (*Nation's Health*, 5 (1923), No. 1, pp. 47-50, figs. 3).—A report is given of the extent of malnutrition in a representative New York public school of 1,814 children, as determined by thorough physical examination by a medical inspector and classification according to the Dunfermline scale and the Wood and the Pirquet standards. The children were fairly distributed in age groups with the exception of the 15- to 16-year-old group, which was so small that it was not included in the final tables. The extent of malnutrition, as judged by the different standards, was as follows:



By the physical examination and grading by the Dunfermline scale, boys 23.5, girls 26.3, and both sexes 25 per cent; by the Wood table of height and weight, 17.7, 29.1, and 22.2 per cent, respectively; by a pelidisi of 93 and under, 31, 37.5, and 33.5 per cent and of 92 and under, 20.5, 25.8, and 22.3 per cent, respectively. It is thought that the pelidisi of 93 and under shows an excessive percentage of undernourishment that does not seem to be warranted as judged by either of the other standards, and that a standard of 92 is more justifiable. The fact that the physical examination showed a higher percentage of malnourishment than either of the other methods (if 92 instead of 93 is used in the Pirquet standard) is thought to indicate that "physical examination of children discovers some cases of undernourishment which may be overlooked by other methods. It also indicates that a complete examination of the children is possible under the conditions which obtain in school life."

**A satisfactory ration for stock rats**, H. STEENBOCK (*Science*, 58 (1923), No. 1509, pp. 449, 450).—The author discusses briefly the stock ration which he has employed for a number of years with excellent results in nutrition experiments on rats. The ration consists of yellow corn 76, linseed oil meal 16, crude casein 5, ground alfalfa 2, sodium chlorid 0.5, and calcium carbonate 0.5 per cent. The ingredients of the ration are finely ground and fed with fresh whole milk and water in separate containers ad libitum. It is stated that when milk is omitted from the ration or cod liver oil is used as a substitute the results are not so satisfactory.

"When available, fresh whole milk produced by cows on a nonvarying ration should be used as a constant ingredient of the stock colony ration, as it serves to cover most efficiently not only known requirements but no doubt many requirements not as yet appreciated. The factor of proper nutritive condition of the young rats before being started on their various dietary regimens is a factor which enters into the results of all experiments and, therefore, is worthy of far greater attention than it is given in most laboratories."

**A note on the nature of the sugar in blood**, J. A. HEWITT (*Brit. Med. Jour.*, No. 3249 (1923), pp. 590, 591).—Exception is taken to the assumption by Winter and Smith (*E. S. R.*, 49, p. 715) that work previously reported by Hewitt and Pryde (*E. S. R.*, 44, p. 259) and their own observations necessarily indicate the presence of  $\gamma$ -glucose as a normal constituent of the blood. "No evidence exists that  $\gamma$ -glucose is a component of normal blood. Theories of diabetes mellitus demanding the presence of  $\gamma$ -glucose in normal blood are without experimental foundation. Formation of  $\gamma$ -glucose in carbohydrate metabolism may take place as and when required, and the active modification may possibly have no more than a transitory existence."

**Glucokinin, II**, J. B. COLLIP (*Jour. Biol. Chem.*, 57 (1923), No. 1, pp. 65-78).—Further observations on the effect of plant extracts on blood sugar (*E. S. R.*, 50, p. 108) are recorded, together with more detailed descriptions of various methods of obtaining potent extracts from plant tissues.

To the list of materials noted in the previous communication as containing glucokinin ordinary lawn grass has been added. Further observations on the varying periods during which the substance appears to retain its activity are noted. A totally depancreatized dog was kept alive for 66 days with only three injections of glucokinin in the form of onion extract. Some evidence was obtained of the presence in the blood of animals maintained in a condition of hypoglycemia of a thermostable hypoglycemia-producing principle which is capable of animal passage by inoculation.

**On a possible relation between the pancreas and the parathyroids**, L. B. WINTER and W. SMITH (*Jour. Physiol.*, 58 (1923), No. 1, pp. 108-110).—It is stated that after a preliminary injection of parathyroid extract into rabbits



convulsions are induced following from one-third to one-fourth the normal dose of insulin.

**Clinical calorimetry.**—XXXIII, The effect of fasting in diabetes as compared with a diet designed to replace the foodstuffs oxidized during a fast, H. B. RICHARDSON and E. H. MASON (*Jour. Biol. Chem.*, 57 (1923), No. 2, pp. 587-611, figs. 2).—The amounts of proteins, fats, and carbohydrates oxidized by several diabetic patients during periods of fasting were determined by the use of the respiration calorimeter. The same amounts of the different food constituents were then given in the diet. The day's allowance was given at 2-hour intervals and the metabolism determined as soon as possible after the last meal.

In all cases the metabolism rose only slightly over the basal level, showing that the replacement diet tended to keep the metabolism at the level previously reached. Although the metabolism as a whole changed but little, the respiratory quotients showed that there was an increase in the quantity of protein and carbohydrate oxidized and of glucose excreted, with a decrease in the amount of fat oxidized. To remedy this it is suggested that the replacement diet be modified by decreasing the protein and carbohydrate and increasing the fat.

**[Insulin in the treatment of diabetes]** (*Jour. Metabolic Research*, 2 (1922), No. 5-6, pp. 545-985, pls. 13, figs. 27).—This issue contains the first detailed reports of the clinical use of insulin. Throughout these reports the necessity of strict dietary control is emphasized, and the principles upon which this control is based are discussed. The various papers and authors are as follows: Insulin in the Treatment of Diabetes Mellitus, by F. G. Banting, W. R. Campbell, and A. A. Fletcher (pp. 547-604); Ketosis, Acidosis, and Coma Treated by Insulin, by W. R. Campbell (pp. 605-635); The Blood Sugar Following Insulin Administration and the Symptom Complex-Hypoglycemia, by A. A. Fletcher and W. R. Campbell (pp. 637-649); Insulin in Hospital and Home, by E. P. Joslin, H. Gray, and H. F. Root (pp. 651-699); Clinical Observations on Insulin, by R. M. Wilder, W. M. Boothby, C. J. Barborka, H. D. Kitchen, and S. F. Adams (pp. 701-728); A Clinical Study of the Effects of Insulin in Severe Diabetes, by J. R. Williams (pp. 729-751); The Effect of Insulin on the Metabolism of Diabetes, by R. Fitz, W. P. Murphy, and S. B. Grant (pp. 753-766); The Use of Insulin in Juvenile Diabetes, by H. R. Geyelin, G. Harrop, M. F. Murray, and E. Corwin (pp. 767-791); The Clinical Use of Insulin, by R. T. Woodyatt (pp. 793-801); and Clinical Observations with Insulin.—I. The Use of Insulin in Diabetic Treatment, by F. M. Allen and J. W. Sherrill (pp. 803-985).

**Clinical observations with insulin** (*Jour. Metabolic Research*, 3 (1923), No. 1, pp. 13-176).—The two papers abstracted below deal with the insulin requirement as affected by modifications in the diet of the diabetic patients whose histories are given in the first paper of the series noted above.

II. *The influence of carbohydrate and protein on diabetes and the insulin requirement*, J. W. Sherrill (pp. 13-59).—This paper presents a series of experiments concerning the insulin requirement of diabetes as modified by alterations in the amount of carbohydrate and protein administered. The data are presented in a tabulation of the amount of protein, fat, carbohydrate, and calories furnished from day to day, with the extent of glycosuria, amount of plasma sugar, urinary nitrogen, weight of patient, and amount of insulin administered. The conclusions drawn are as follows:

"Carbohydrate has a stronger glycosuric effect and creates a higher insulin requirement than the caloric equivalent of any other kind of food.



"Protein ranks below preformed carbohydrate in respect to glycosuric effect and insulin requirement when the substitution is made on a basis of either equal caloric value or theoretical glucose content. Though hypoglycemia may be prevented by sufficiently large quantities of protein, this influence is surprisingly feeble and by no means in proportion to the theoretical glucose value.

"Assumptions of a specially powerful glycosuric influence of protein, on the ground either of its specific dynamic or a supposed toxic action, are thus proved to be contrary to fact.

"There is no constant scale of insulin dosage for the assimilation of any given quantity of carbohydrate. The ratio between grams of glucose and units of insulin varies widely not only in different patients but also in the same patient under different conditions.

"Glycosuria and insulin requirement are governed to a very important degree by the total caloric value of the diet."

III. *The influence of fat and total calories on diabetes and the insulin requirement*, F. M. ALLEN (pp. 61-176).—The experimental data presented in this study are prefaced by a review and discussion of the theories upon which different methods of dietary control in diabetes have been founded. The theory upon which the author bases his undernutrition treatment is that "the diabetic condition is affected by all energy carriers of the diet and by the body weight, either because the pancreatic island function is directly concerned in total metabolism, or because the supply of other food materials in some way influences the utilization of glucose."

The results obtained in the present study are thought to confirm this theory. "The food which tends most strongly to produce glycosuria and which therefore breaks down the tolerance most rapidly is carbohydrate. Protein comes second, and its glycosuric action in average cases is not equal to its theoretical glucose value. Fat seems to be important chiefly through the number of calories furnished by it, rather than as a theoretical direct source of glucose. The most important factor governing the insulin requirement with any ordinary plan of diet is not the carbohydrate content but the total caloric content."

The principal factors governing the insulin requirement are summarized as the severity of the diabetes, infection, acidosis, food, metabolism, muscular exercise, and body weight. The paper should be consulted in the original for the discussion concerning the relative influence of these factors.

**On the absorption of insulin from the stomach**, L. B. WINTER (*Jour. Physiol.*, 58 (1923), No. 1, pp. 18-21).—Evidence is presented that insulin in weak alcoholic solution administered to rabbits per os is rapidly absorbed and causes as prompt a reduction in blood sugar as when injected subcutaneously. In control experiments with similar amounts of insulin in normal saline solution or in N/20 NaOH negative results were obtained.

**Possible sources of insulin**, C. H. BEST and D. A. SCOTT (*Jour. Metabolic Research*, 3 (1923), No. 1, pp. 177-179).—The authors report the presence in potatoes, rice, wheat, beet roots, and celery of a substance capable of causing in rabbits a marked lowering of blood sugar. Protocols are given of the work with potatoes and rice.

**The action of proteolytic enzymes upon insulin**, E. J. WITZEMANN and L. LIVSHIS (*Jour. Biol. Chem.*, 57 (1923), No. 2, pp. 425-435).—In this paper an attempt has been made to explain the apparently contradictory properties of different preparations of insulin. Data are reported on the effect of the enzymes trypsin, papain, and pepsin on iletin (commercial insulin) and on insulin prepared in the laboratory by the Collip method.

In all cases the activity of the preparation was destroyed by the action of the enzyme. In the authors' opinion the three types of insulin preparations



which have thus far been obtained by the different methods employed may be called the protein type, which is insoluble in water and gives a blue-violet biuret test; the peptone-polypeptid type, differing from the former by being soluble in water and giving a red biuret test; and the abiuret type, which gives neither the biuret nor the qualitative reactions of proteins. Two interpretations of these differences in properties are suggested, one that insulin is a simple polypeptid giving no typical protein reactions but readily adsorbed by more complex protein derivatives, and the other that it is a "group or radical present in certain proteins which is easily hydrolyzed by proteolytic enzymes. This radical may occur in protein compounds of greater or less complexity and, therefore, its qualitative reactions will range all the way from a negative biuret, for the simplest group that still retains the characteristic properties of insulin, to those of a typical protein." The second interpretation is thought to be the more plausible.

**Studies on yeast.—VII, The dietary properties of yeast,** V. E. NELSON, V. G. HELLER, and E. I. FULMER (*Jour. Biol. Chem.*, 57 (1923), No. 2, pp. 415-424, figs. 4).—This continuation of the series of studies on yeast (E. S. R., 50, p. 362) deals with the value of yeast as a source of vitamin B and proteins. In the vitamin tests young rats weighing from 50 to 60 gm. each were fed a ration of casein 18, McCollum's salt mixture 185 3.7, filtered butterfat 5, yeast in varying amounts from 1 to 8 per cent inclusive, and dextrin to 100 per cent. The casein was purified by washing for several weeks with water acidified with acetic acid, and the dextrin was prepared by moistening starch with 1 per cent citric acid solution and autoclaving the mixture at 20 lbs. pressure for 3 hours. The yeast used was *Saccharomyces cerevisiae* (Fleischmann's Race F).

When the yeast constituted 1 per cent of the ration, growth was below normal and none of the females reproduced. With 1.5 per cent of yeast growth was somewhat better and 2 of the females reproduced, but the young died shortly after birth. With 2 per cent and larger amounts of yeast normal growth and reproduction took place. The young were normal in weight at birth and the litters were of average size, but the majority died during the suckling period if kept with mothers on the yeast diet. Of the total number of 308 young born, only 53 lived to maturity. Of the animals on 2.5 per cent yeast, 15 young were reared, but of these only 6 were brought to maturity on the yeast diet. The remaining 9 received 1.5 cc. daily of tomato juice in addition to the yeast. This addition proved partially successful in preventing mortality, while the same amount of orange juice was unsuccessful. On 5 per cent of the yeast the second generation grew normally and reproduced, and some of the third generation have been reared.

In discussing the failure of the young to grow normally on the yeast dietaries the possibility is suggested of an unfavorable balance of the other dietary factors, such as an excess of fat or an unfavorable salt mixture, as being a contributory factor. "Future work will determine whether the failure of the young to grow on these various levels of yeast is to be ascribed to the difference in vitamin B necessary for growth and that required for milk secretion and normal milk composition, or whether another unknown dietary factor must be taken into account. Evidence accumulated in this laboratory indicates that it is not alone a question of the level of vitamin B."

In the study of the value of the yeast proteins, the yeast was fed at 25, 30, 35, 40, 45, and 50 per cent levels (on the dry basis) in a ration containing in addition sodium chlorid 1, calcium carbonate 1, filtered butterfat 5, and dextrin to 100 per cent. These amounts of yeast were calculated to furnish 11.5, 13.8, 16.1, 18.4, 20.7, and 23 per cent of crude yeast protein. On this ration growth



and reproduction of the first generation were normal and growth in the second generation was below normal, particularly on the 25 per cent level. In spite of this, a third generation has been produced which in turn grew at less than normal rate. "Whether the failure of the young to grow normally is due to an inadequacy of the ash constituents, an insufficiency of amino acids, or to both of these factors, it is difficult to say."

**The growth of yeast on a medium of wholly synthetic origin,** E. I. FULMER, V. E. NELSON, and A. WHITE (*Jour. Biol. Chem.*, 57 (1923), No. 2, pp. 397-399).—The authors report the successful growth of yeast in successive transplants in a medium identical with medium E of an earlier study (*E. S. R.*, 45, p. 765), with the exception that a synthetic carbohydrate, methose, was used as a substitute for cane sugar.

**Feeding experiments on rats with plants at different stages of development.—I, Experiments with corn,** B. HARROW and F. KRASNOW (*Jour. Metabolic Research*, 2 (1922), No. 4, pp. 401-415, figs. 6).—This is the first of a series of studies planned to trace the development of vitamins in plants, beginning with the seed and ending with the flower. The present report covers a few preliminary studies on a comparison of germinated, ungerminated, and seedling corn as a source of vitamins A and B.

Young rats from the same litter were fed a basal diet of purified casein 18, cornstarch 54, lard (heated and oxidized for 24 hours) 24, and salt mixture 4 parts, with 300 cc. of water. One group of 3 animals received this diet with the addition of 5 per cent of cod liver oil and 2 per cent of marmite to supply vitamins A and B. Two other groups of 3 each received the basal diet with 5 per cent of air-dried ungerminated and germinated corn, respectively. In 52 days the percentage increase in weight of the rats in the three groups was 91.7, 51.5, and 52.5 per cent, respectively. This is thought to show that no compound essential to the growth of rats was produced in the corn by germination. Similar results (for vitamins B or D) were obtained with the yeast method of Funk and Dubin (*E. S. R.*, 44, p. 861).

As judged by similar tests, alcohol in concentrations of from 50 to 80 per cent failed to extract appreciable quantities of vitamins from germinated or ungerminated corn. Fresh undried material, either ungerminated, germinated, or in the seedling stage, when added to the basal diet caused a temporary increase in weight, followed by a sharp decline. Seedlings in the dried state gave slightly better results than either ungerminated or germinated corn.

**Vitamins and bacterial growth,** G. A. WYON (*Jour. Path. and Bact.*, 26 (1923), No. 4, pp. 441-445).—In this extension of the investigation by M'Leod and Wyon previously noted (*E. S. R.*, 46, p. 80) the possibility of amino acids being the potent factors in the growth of bacteria was studied, first by a comparison of the relative growth potency for a large number of microorganisms of autolyzed yeast and of the same material from which a large part of the amino acids had been removed. The tests showed a rough proportionality of growth to amino acid content irrespective of the content of vitamin B, but did not show conclusively that vitamin B has no value to bacteria.

Various suggestions are given as to the nature of the potent factors in such materials as blood, animal organs, and yeast extract. These include the possibility that the favorable effect is due to the presence in the materials of catalase which tends to break down the hydrogen peroxid formed by certain bacteria, or that it is due to the adsorption by the active material, such as blood, of other inhibitory substances. Other factors suggested are the new organic sulphur-containing amino acid, isolated by Mueller (*E. S. R.*, 49, p. 714), or purin bases or amino acids. Negative results were obtained, however, when pure purins and amino acids were added as growth stimulants.



**The relation of deprivation of vitamin B to body temperature and bacterial infection,** G. M. FINDLAY (*Jour. Path. and Bact.*, 26 (1923), No. 4, pp. 485-495, figs. 2).—To determine in what way the lack of vitamin B brings about diminished resistance to bacterial infection, an investigation was first made of the changes in the bone marrow and lymph tissues of rats on diets complete except for vitamin B.

While congestion and hemorrhage of the bone marrow resulted, similar changes were brought about by feeding rats a diet containing adequate vitamin but low in proteins. A similar condition was noted in pigeons fed on polished rice. Two possible explanations are suggested, one, that in the low protein diet the excess of carbohydrate resulted in a relative deficiency in vitamin B, and the other, that the real deficiency in the diet supposedly deficient in vitamin B alone was that of protein, owing to the inability of the animals to utilize all of the food on account of the loss of appetite resulting from the lack of vitamin B. This is considered to be the more probable explanation. Similarly, atrophy of the spleen, thymus, and lymphoid tissue of pigeons on polished rice is considered to be due quite as much to lack of proteins as of vitamins.

In investigating the relation of bacterial infection to polyneuritis in pigeons, it was found that their natural immunity to artificial infection with certain microorganisms was destroyed during polyneuritis only after the body temperature had fallen during the course of the disease to below 40° C. This is thought to indicate that the decreased resistance was brought about in some way by the fall in body temperature. A study of the possible means by which the body temperature controls the resistance to infection has led to the conclusion that several factors are involved. In the case of microorganisms like the pneumococcus and meningococcus, the normal high body temperature inhibits the growth of the organism, while a lowered temperature facilitates the growth. Other possible factors are the reduction of the leucocytic response to the infection and the reduction of the bactericidal power of the leucocytic exudate.

**On the identity or nonidentity of antineuritic and water-soluble B vitamins,** P. A. LEVENE and M. MUHLFELD (*Jour. Biol. Chem.*, 57 (1923), No. 2, pp. 341-349, figs. 2).—A comparison is reported of the relative protective power for rats and pigeons of 3 samples of bakers' and 1 of brewers' yeast. The basal diet for the rats consisted of casein 18, salt mixture 4, starch 54, butterfat 9, lard 13, and cod liver oil 2 parts. Young rats were placed in individual cages and fed this diet until they had definitely lost in weight, when the vitamin was given in tablet form. Four or more animals were used for each sample of yeast tested. For the pigeon experiments birds weighing over 300 gm. were used, 3 for each of the yeasts. The birds were kept in individual cages and were forcibly fed 20 gm. of ground white rice, 18 cc. of distilled water, and the yeast, the experiment being continued for at least 63 days.

In the rat experiments all the samples of yeast promoted normal growth in daily doses of 0.2 gm., while with doses of 0.1 gm. normal growth was obtained with the brewers' yeast and 1 sample of bakers' yeast, and less satisfactory results with the other 2 samples. In the pigeon experiments very irregular results were obtained. Brewers' yeast protected the pigeons from polyneuritis in daily doses of 0.5 gm. One sample of bakers' yeast gave irregular results in doses of 0.2 gm. and complete protection in doses of 0.5 gm. Of the other two samples of bakers' yeast, 1 failed to protect in doses of 0.5 gm. and gave irregular results in doses of 1 gm., and the other failed to protect in doses of 2 gm. daily.



It is thought that these results furnish additional evidence in support of the view that the antineuritic vitamin and the growth-promoting vitamin B are not identical.

The relation between the growth-promoting and antirachitic functions of certain substances, H. GOLDBLATT and S. S. ZILVA (*Lancet* [London], 1923, II, No. 13, pp. 647-649, fig. 1).—Cod liver oil of known growth-promoting and antirachitic values was heated at a constant temperature of 120° C. while a continuous current of air was passed through it. Portions of the oil were removed after 6, 12, 18, and 24 hours and tested on rats for growth-promoting and antirachitic properties. For the estimation of the growth-promoting property the method of Zilva and Miura (*E. S. R.*, 46, p. 806) was used, and for the antirachitic property preventive tests with the use of McCollum's rickets-producing diet characterized by being low both in phosphorus and antirachitic vitamin. In both cases the minimum dosage for protection was determined by starting with quantities within rather wide limits and properly grading the intervening doses. In testing for antirachitic vitamin 208 animals were used and for the growth-promoting vitamin 4 animals for each separate dose.

The final values for the calculated minimal protective doses with respect to the growth-promoting and antirachitic function are as follows: For crude cod liver oil 2.2 and 3.3 mg., respectively; cod liver oil oxidized for 6 hours 7.9 and 9; and oxidized for 12 hours 50.6 and 20.2. The oil which had been oxidized for 18 hours failed to promote growth in doses of 450 mg., while the minimal protective dose against rickets was 78.7 mg. Of the oil oxidized for 24 hours 450 mg. failed to protect against rickets. These figures show that while the initial potency of the crude oil was somewhat greater for growth promotion than for protection against rickets, the growth-promoting function was destroyed much more rapidly by oxidation than was the antirachitic function.

A sample of hardened cod liver oil was also tested for the two functions, and was found to give protection against rickets in doses of 33.7 mg. daily and to promote growth in doses of 1.8 mg.

Further proof of the nonidentity of the growth-promoting and antirachitic factors was afforded by a comparison of the distribution of the two factors in spinach. The minimal growth-promoting dose of freshly ground leaves was found to be between 0.1 and 0.25 gm., while even 3 gm. daily, the largest dose which could be administered, had no effect in promoting calcium deposition. These results confirm those reported by McClendon and Shuck (*E. S. R.*, 50, p. 263) and by Zucker et al. noted below.

Observations on the distribution of antirachitic substances, T. F. ZUCKER and M. BARNETT (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 7, pp. 375-378).—The authors have prepared concentrated extracts of butter, coconut oil, spinach, carrots, pig's liver, and sheep's adrenals by the method previously described for concentrating the antirachitic substance in cod liver oil (*E. S. R.*, 49, p. 608), and have tested these extracts for antirachitic properties, but with negative or nearly negative results. The favorable action obtained by McCollum with coconut oil is attributed to the formation in the intestines of the experimental animals of insoluble calcium salts which render more phosphorus available for absorption.

"While we can not say that we have proved the nonexistence of an antirachitic vitamin, the facts adduced certainly detract from the plausibility of the assumption that there is one. Until the presence of such a vitamin is established in natural infants' diets in cases where rickets is prevented and a deficiency in diets of cases where rickets occurs, it will be safer to approach



the subject with an open mind. The rickets-curing substances in cod liver oil and in egg yolk might just as well be looked upon as therapeutic agents, possibly internal secretions, which will prevent or cure rickets.

**The various forms of phosphoric acid in the blood.**—**Findings in rickets**, T. F. ZUCKER and M. GUTMAN (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 7, pp. 372-375).—Supplementing previous work on the distribution of phosphorus in the blood in rickets (*E. S. R.*, 47, p. 467), data are presented on the total distribution of phosphoric acid in the blood in rickets with and without anemia, in nonrachitic blood with and without anemia, and in non-rachitic and rachitic rat blood.

The total acid-soluble phosphorus was not lower in rachitic than in normal children except in the case of anemia, which causes a reduction in the acid-soluble phosphorus. In rachitic children the inorganic phosphate was lower than normal, both in absolute amounts and in proportion to the total, while the nonhydrolyzable phosphorus was increased.

In rachitic rats there was a decrease in inorganic phosphate, an increase in the nonhydrolyzable phosphate, and irregularities in the total acid-soluble phosphate.

**Rickets in the human species**, H. DORLENCOURT (*Rev. Path. Compar.*, 23 (1923), No. 239, pp. 1-12).—A review and discussion of the literature on the subject.

**Report of a fatal case of keratomalacia in an infant, with post-mortem examination**, J. R. WILSON and R. O. DuBois (*Amer. Jour. Diseases Children*, 26 (1923), No. 5, pp. 431-446, figs. 9).—A detailed report is given of the post-mortem examination of an infant 5 months old who died of keratomalacia following exclusive feeding of diluted condensed milk for a long period of time. In addition to the lesions occurring in the eyes (corneal ulcers with perforation of the cornea), microscopic examination showed extensive changes in many other organs of the body resembling in a striking manner the changes observed in experimental animals on diets lacking in vitamin A. These included inflammatory lesions of the lacrimal and salivary glands and keratinization of the bronchial and other epithelial linings. In connection with the fact that cod liver oil was administered several days before death with apparently no favorable effect, it is of interest that the lesions observed in the lacrimal glands resembled those reported by Yudkin and Lambert (*E. S. R.*, 50, p. 463) in the lacrimal glands of experimental rats cured of ophthalmia. This would appear to indicate that the addition of cod liver oil may have had some effect on the lacrimal glands.

**Prolongation of the survival period in thymectomized scorbutic guinea pigs**, J. LOPEZ-LOMBA (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 24, pp. 370, 371).—The author reports in guinea pigs of corresponding weight at the beginning of the experiment a small but consistent lengthening of the survival period in thymectomized animals as compared with ordinary controls.

**Xerophthalmia in Denmark from 1909 to 1920**, O. BLEGVAD (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 21, pp. 197-200).—This general discussion of the prevalence of xerophthalmia in Denmark from 1909 to 1920 supplements a previous report by Bloch (*E. S. R.*, 45, p. 668), in that a longer period of observation is included. The present study comprises 453 cases (434 infants and 19 adults).

It is noted first that the frequency of the cases varied in a significant manner during the period covered. From 1909 to 1917 there was a marked increase (20 cases in 1909, 78 in 1916, and 71 in 1917). This was followed by a marked diminution in 1918 and 1919, 9 and 4 cases, respectively. In 1920 the number rose to 25. The relative consumption of margarin and butter varied



during these same periods, the years 1918 and 1919 being those in which margarin was not manufactured in Denmark and butter was rationed in such a way that it was used by even the poorest people.

The frequency of the disease among breast-fed infants is mentioned as illustrating the importance of a sufficiency of vitamin A in the diet of nursing mothers. The greater incidence of the trouble in the winter and spring is explained partly as the result of the lowered content of vitamin A in the milk during the winter when the animals are stall-fed. This would tend to manifest itself more quickly in the skim milk and centrifuged milk used during the years of greatest incidence of the disease. The more rapid growth of children in the spring, with consequent increased requirement of vitamin A, is considered to be another factor responsible for the increased incidence of xerophthalmia in the spring.

The mortality was highest in the youngest children, but the fatal cases among the older children were of shorter duration. Among the survivors 27 per cent became blind, 24 had their sight markedly reduced, 35 retained the sight in one eye, and 14 per cent were cured, with no defects in vision. The keratomalacia was generally preceded by a decrease in weight.

### ANIMAL PRODUCTION.

**On changes in the relative weights of the viscera and other organs from birth to maturity—albino rat, H. H. DONALDSON** (*Amer. Jour. Physiol.*, 67 (1923), No. 1, pp. 1-21, figs. 21).—This consists of a study from the Wistar Institute of the rate of increase from birth to maturity (400 gm.) in the weights of the organs of rats, and the relation to total body weight and the weight of other organs, based on the studies previously reported by the author (*E. S. R.*, 40, p. 546) and by Hatai (*E. S. R.*, 42, p. 559). The organs included in the study were lungs, hypophysis, thyroid, submaxillaries, kidneys, heart, pancreas, spleen, suprarenals, liver, intestinal tract, and stomach, which were collectively called the viscera, and in addition the blood, eyeballs, brain, spinal cord, thymus, testes, ovaries, and epididymis. The relation of the weights of the organs to body weight were very nearly the same in both sexes except for the hypophysis and suprarenals. These were proportionately greater in the females after 50 gm. in body weight had been attained, reaching nearly twice as much relatively at 400 gm. in the females as in the males.

The time at which the different organs made up the largest percentage of the total body weight varied from birth (4.7 gm.) to puberty (100 gm.) or later. The lungs and blood (the oxidizing organs) had their maxima at birth, as did also the glands related to growth, the hypophysis, and the thyroid. The maxima for the submaxillaries, eyeballs, kidneys, heart, and brain occurred in that order between birth and 11.4 gm. Between 15.9 and 34.9 gm. body weight, the alimentary organs and others reached their maxima in the order of pancreas, spleen, suprarenals, liver, intestinal tract, and stomach, followed by the thymus at 53.6 gm., and finally with the gonads at 100 gm.

At 400 gm. the body weight had increased about 81.6 times as compared with birth, whereas the weight of the viscera had increased about 79 times. Thus at maturity the viscera bear a relation to body weight which is similar to that at birth, though the relationship of the different organs is changed. The intestinal tract and spleen were the only organs to show significant increases in rate of gain over the average gain of the other organs of the viscera.

A brief discussion of the relation of the organs to the blood at different body weights indicates that the larger animals are much at a disadvantage in

relation to the blood supply of the entire animal and of most of the individual organs.

**Studies of the thyroid apparatus.—XVIII, The differential development of the albino rat from 100 to 150 days of age and the influence of thyro-parathyroidectomy and parathyroidectomy thereon, F. S. HAMMETT** (*Amer. Jour. Physiol.*, 67 (1923), No. 1, pp. 29-47).—The relationship between total body weight and the weights of the liver, testes, brain, kidney, lungs, heart, pancreas, epididymis, spleen, cord, submaxillaries, eyes, thymus, thyroid, adrenal, hypophysis, femur, and humerus are shown for male and female rats at 150 days of age which had been thyroidectomized (including the removal of the parathyroid) or parathyroidectomized at 100 days of age. These relationships are compared with controls killed at 100 days and 150 days of age.

The results, which are tabulated in detail, indicate that the removal of the parathyroid or parathyroid and thyroid disturbs the growth of practically all the organs studied, making their variability greater. As in previous work on other parts of the body (*E. S. R.*, 48, p. 870), the retardation was in most cases more pronounced in females than in males. The lungs, heart, kidneys, spleen, liver, adrenals, pancreas, and thymus in thyroidectomized rats not only ceased to grow but actually lost weight.

In regard to the association of the weight of the organs with body weight and length, it was found that the weight of the brain, spinal cord, eyeballs, and the length of the humerus, femur, and tail were more closely associated with body length than with body weight, whereas the weight of the liver, kidneys, spleen, thymus, epididymis, uterus, and ovaries show a closer correlation with body weight.

**The thyroid gland and development, F. S. HAMMETT** (*Jour. Heredity*, 14 (1923), No. 7, pp. 291-296, figs. 2).—On the basis of the data from the experiments on the increase in weight of the organs of rats thyroidectomized at 100 days of age as noted above, the author shows that the effect of thyroidectomy on growth during the succeeding 50 days was not the same in all organs, the brain, spinal cord, ovaries, and testes being especially considered. The relation of changes in the thyroid gland to puberty, menstruation, pregnancy, and menopause is discussed in relation to the loss of 236 per cent in the weight of the ovaries which occurred after thyroidectomy in these rats, as compared with an increase in weight of the testicles of 51 per cent of the increase made by normal rats.

**Conservation of fodder.—Pit silage for starving stock, A. H. E. McDONALD** (*Agr. Gaz. N. S. Wales*, 34 (1923), No. 8, pp. 533-545, figs. 3).—This is essentially a description of the method of making a pit silo, with suggestions as to the most desirable types of plants to use for such silage.

**Succulent fodders, vitamins, prickly pear, A. STEAD** (*Union So. African Dept. Agr. Jour.*, 7 (1923), No. 2, pp. 122-130, fig. 1).—The importance of succulence and vitamins in the rations of farm animals is discussed, followed by a description of the experiences of several farmers in using prickly pear as a feed to tide over periods of drought. The leaves were pulped or the spines singed to prevent injury to the animals consuming them.

**Inspection of commercial feedstuffs, P. H. SMITH, F. J. KOKOSKI, and J. T. HOWARD** (*Massachusetts Sta. Control Ser. Bul.* 24 (1923), pp. 32).—The usual report of the feeding stuffs inspections for the year ended September 1, 1923, is given (*E. S. R.*, 48, p. 568).

**A handbook for better feeding of livestock, compiled by E. W. SHEETS and W. JACKSON** (*U. S. Dept. Agr., Misc. Circ.* 12 [1924], pp. 48).—A popular discussion of the principles of livestock feeding.



**Quality of proteins in nutrition**, D. B. JONES (*Feedstuffs*, 1 (1923), No. 14, pp. 19, 20, 25, 26).—This is a brief discussion of the importance of the quality of protein in feeding stuffs, with some reference to the results of experiments with rats for determining the quality of proteins in different feeds at the Bureau of Chemistry, U. S. D. A.

**Animal management, 1923** (London: [Gt. Brit.] War Off., Vet. Dept., 1923, pp. 374, pls. 8, figs. 51).—This book consists mainly of the general principles of feeding, management, care, and diseases of horses, with a chapter on the mule, donkey, camel, and ox.

[**Beef cattle experiments at the Lacombe Experimental Station**], F. H. REED (*Canada Expt. Farms, Lacombe (Alta.) Sta. Rpt. Supt. 1922*, pp. 10–13, fig. 1).—Records of the feed consumed by cows and 2-year-old heifers wintered in the open, yearling heifers in a corral, nursing stock during the winter, bulls from birth to 1 year of age, and by heifers from birth to 2 years of age are given, and the calculated costs determined.

**I. Fattening steers on cottonseed meal and hulls with and without corn.**

**II. The influence of age on fattening steers**, J. M. JONES, J. L. LUSH, and J. H. JONES (*Texas Sta. Bul. 309* (1923), pp. 5–31, fig. 1).—To compare the rate and economy of gains made by steers on rations of cottonseed meal and cottonseed hulls with and without the addition of shelled corn, two lots of 32-month-old grade Hereford steers were selected for a 120-day feeding test. The average daily rations per 1,000 lbs. live weight for lot 1 consisted of cottonseed meal in amounts of 4, 3.25, and 2.5 lbs. during the first and second 30 days and the last 60 days, respectively; ground shelled corn 9.5, 10.75, and 12 lbs., respectively; and cottonseed hulls 24, 17.5, and 15 lbs. during the first and second 30 days and the last 60 days, respectively. Lot 2 received 6 lbs. of cottonseed meal and 24 lbs. of cottonseed hulls daily per 1,000 lbs. live weight throughout the experiment. To study the influence of age on fattening a third lot of steers or similar breeding but one year younger were fed like lot 1.

The summary of the results of the experiments given in the table below shows that the difference between lots 1 and 2 was more in favor of the corn fed steers during the latter part of the feeding period. The finish was also better in the corn fed lot. One steer in lot 2 developed an abscess toward the end of the test and has not been included in the results.

In regard to the effect of age on the rate and economy of gain, the results showed that the gains per steer were slightly greater for the older animals, but the younger steers made more economical gains and greater gains per 1,000 lbs. live weight. Four, and part of the time five, hogs were allowed to follow the steers in lots 1 and 3, and the gains made by these hogs were compared with the gains made by a check lot self-fed on corn and tankage. The hogs following the steers also received additional feeds, but it was calculated that they produced 10.94 and 7.09 lbs. of pork per steer from the droppings in lots 1 and 3, respectively.

In considering the financial phases of the two feeding trials, the authors concluded that it is usually profitable to feed corn with cottonseed meal and cottonseed hulls unless the corn is unusually high in price in relation to the value of the other feeds. The best age for fattening depends on a number of factors. The feeding period for older cattle is shorter and more or less fixed and the profits are greater when the margin between buying and selling price is large. With young cattle, the feeding period is longer and more elastic and the profits are usually smaller but less speculative.

*Summary of the results of the test in fattening steers on cottonseed meal and cottonseed hulls with and without shelled corn.*

Lot.	Period.	Number of steers.	Average initial weight.	Average daily gain.	Feed consumed per 100 lbs. gain.			Cost of feed per 100 lbs. gain.	Selling price per 100 lbs. live weight.	Dressing percentage.	Profit per steer. <sup>1</sup>
					Cottonseed meal.	Shelled corn.	Cottonseed hulls.				
			Lbs.	Lbs.	Lbs.	Lbs.	Lbs.				
1----	First 90 days--	11	840.1	3.30	96.8	326.5	651.7	\$10.89			
2-----	do-----	10	848.5	2.65	227.8		963.1	8.95			
1-----	First 120 days--	11	840.1	3.22	100.5	376.4	642.2	11.81	\$9.13	60.72	\$8.96
2-----	do-----	9	834.4	2.41	256.1		1,079.2	10.04	8.28	59.58	7.34
3-----	do-----	15	534.1	2.77	83.1	315.1	552.4	9.94	8.54	59.30	6.95

<sup>1</sup> Profit over marketing costs and feed costs—ground corn at \$1.01 per bushel, cottonseed meal \$1.83 per hundredweight, cottonseed hulls \$9.92 per ton.

**Feeding range ewes,** W. E. JOSEPH (*Natl. Wool Growers*, 13 (1923), No. 10, pp. 28, 29).—The yearling ewes which were fed during the preceding winter as lambs at the Montana Experiment Station (E. S. R., 50, p. 574) were again used for a comparative feeding test of four rations. Lot 1 received 3.3 lbs. of alfalfa hay per head per day; in lot 2, 0.75 lb. of hay was replaced by 0.23 lb. of corn; in lot 3, 0.72 lb. of hay was replaced by 0.22 lb. of cottonseed cake (42 per cent protein); and in lot 4, 0.67 lb. of hay was replaced by 2.17 lbs. of sunflower silage. The condition of the ewes and fleeces at the end of the test was described as satisfactory in all lots, and the average gains were also similar, varying from 12.2 to 13.4 lbs.

**[Swine experiments at the Lacombe Experimental Station],** F. H. REED (*Canada Expt. Farms, Lacombe (Alta.) Sta. Rpt. Supt. 1922*, pp. 38-48).—The experiments with swine consisted mostly of feeding tests.

**Five per cent v. ten per cent tankage for growing hogs on pasture.**—One lot of five 20-lb. pigs on pasture gained 379 lbs. in 85 days when receiving a supplement of 10 per cent of tankage to a ration of equal parts of shorts, oat chop, and barley chop for the first six weeks and oat and barley chop for the rest of the test. Another lot gained 366 lbs. on a like ration except that only 5 per cent of tankage was given. The 5 per cent tankage ration, however, cost less to produce 100 lbs. of pork.

**Tankage v. oil cake meal for weaned hogs.**—The addition of 10 per cent of tankage and 10 per cent of oil cake was compared as a supplement to the ration fed in the above experiment and on pasture by using two lots of boars and two lots of sows. The boars received each ration in self-feeders, whereas the rations were fed to the sows as a slop three times daily. The average daily gains in the 85-day test by the boars and sows receiving oil cake were, respectively, 0.668 and 0.783 lb., and by those receiving tankage 0.79 and 0.785 lb.

**Comparison of crossbred hogs using a long Yorkshire boar on Duroc-Jersey and Berkshire sows.**—In an 85-day comparative feeding experiment, crossbred Yorkshire-Duroc-Jersey pigs were found to be larger, less liable to sun scald, earlier in maturing, and more economical to fatten than Yorkshire-Berkshire crossbreds, though the latter were more compact.

**Peas v. barley as a fattening meal for hogs.**—The results are reported of a comparative test of the gains made by hogs on a ration of oats and barley, equal parts, and oats and peas when self-fed with whey in addition at the rate



of 9 lbs. per head daily. The average daily gains during the 26-day test were 1.56 lbs. on the oat and pea ration and 1.26 lbs. on the oats and barley. The hogs also consumed more of the pea ration, making the costs of gain practically equal.

*Swine breed test.*—In an 84-day test the rates of gain of sows and boars of the Yorkshire, Berkshire, and Duroc-Jersey breeds were compared. The average daily gains made by the sows and boars, respectively, of the different breeds were Yorkshires 0.997 and 1.123 lbs., Berkshires 0.815 and 1.089 lbs., and Duroc-Jerseys 0.930 and 1.303 lbs. The average feed costs of gain were for the sows and boars of the Yorkshire breed 3.06 cts. per pound, Berkshires 3.25 cts., and Duroc-Jerseys 3.4 cts. The Yorkshires also furnished the type of carcass most in demand by the packers.

*Fall v. spring litters.*—A comparison of the feed and pasture costs indicates that fall pigs were not quite as profitable as spring pigs. In the latter case 100 lbs. of gain cost \$3.34 as compared with \$4.41 in fall pigs. Greater profits apparently come from early fall pigs than from those born later in the fall.

**Feed requirements per kilogram of live weight of fattening pigs, N. HANSSON** (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 246 (1923), pp. 23, figs. 2*).—This is a more detailed report of the summary of the feed requirements of the pigs used in the experiments at the Swedish Agricultural Experiment Station near Stockholm previously noted (E. S. R., 50, p. 673).

**The brood sow, R. G. KNOX and W. TOOLE** (*Ontario Dept. Agr. Bul. 301 (1923), pp. 16, figs. 11*).—Practical directions for the selection, feeding, and management of the brood sow are given.

**[Poultry] experimental work at the Central Farm, F. C. ELFORD** (*Canada Expt. Farms, Poultry Div. Rpt. 1922, pp. 5-20, figs. 8*).—Another year's results of the investigations with poultry are reported (E. S. R., 49, p. 69).

*Four methods of feeding growing chickens.*—Four lots of 52 May-hatched chicks each were selected on August 1, 1922, for comparing different methods of feeding. Lot 1 received a commercial scratch feed and a home mixed dry mash in self-feeders, with a small quantity of wet mash moistened with buttermilk once daily. In lot 2 the scratch grain was hand-fed twice daily, but otherwise the feeding was the same as for lot 1. The scratch grain and dry mash were both hand-fed twice daily to lot 3 by moistening the mash with buttermilk and by mixing in some chopped green feed. Lot 4 received the dry mash self-fed and the wet mash twice daily, but no scratch grain. The respective lots made gains of 80, 90, 91.5, and 91 lbs. The birds consumed from 369 lbs. of feed in lot 2 to 447 lbs. in lot 4. The birds in lot 2 were in the best condition.

*Duck feeding experiments.*—One lot of 30 Pekin ducks fed on mash and green feed averaged 5 lbs. 7 oz. per duck in weight at the end of 12 weeks as compared with 5 lbs. 10 oz., the average weight of another lot receiving similar treatment and feeds except that no green feed was given. The average feed costs except for green feed were the same in both lots. For a comparison of breeds in the production of green ducks, 24 Indian Runners and 25 Muscovies were fed the same as the above lot of Pekins which received green feed. The average weights at the end of 12 weeks were 4 lbs. 2 oz. for the Runners and 5 lbs. 11 oz. for the Muscovies. The average costs of feed except green feed were 55 cts. for the Pekins, 52 cts. for the Runners, and 41 cts. for the Muscovies. The results indicate the advisability of marketing the Indian Runners earliest and the Pekins at a later date, but earlier than the Muscovies.

*Feeding laying hens.*—The egg production of six lots of 15 White Leghorn hens each was determined from November to April when the lots received different kinds of commercial scratch feed and commercial or home mixed mash. The home mixed mash consisted of equal parts of bran, middlings, corn meal, ground oats, and beef scrap. The two pens receiving home mixed mash averaged 995 eggs, whereas the most laid by any pen receiving commercial mash was 949. Less feed was also required with the home mixed mash, and the profits were greater.

[*Poultry experiments at the Lacombe Experimental Station*], F. H. REED (*Canada Expt. Farms, Lacombe (Alta.) Sta. Rpt. Supt. 1922, pp. 106-109*).—These investigations were largely confined to hatching and feeding experiments.

[*Hatching experiments*].—A comparison of the April and May hatching results showed that the eggs hatched in April were 60 per cent fertile as compared with 80 per cent in May, 39.72 per cent of the fertile eggs hatched in April as compared with 20.35 per cent of those hatched in May, and the percentage of chicks born which were alive on July 1 was for the April hatching 75 per cent as compared with 47 per cent for the May hatching. Only 23.5 per cent of the fertile eggs set in a Candee 1,200-egg incubator hatched as compared with 64.2 per cent in a Cyphers 240-egg machine. The fertility and hatching results of the eggs of three breeds were compared with the following results: Fertility of Wyandottes 74, Barred Rocks 76, and Single Comb Rhode Island Reds 60 per cent, and the hatching percentages of the fertile eggs 24.8, 33, and 35.4 per cent, respectively. A comparison of hens' and pullets' eggs for hatching showed that the fertility was 80 per cent in hens' eggs and 60 per cent in pullets' eggs, but the hatching percentages of the fertile eggs were, respectively, 25.4 and 31.5 per cent.

Hatching and shipping day-old chicks from the Saanichton Experimental Station to the Lacombe Station was found more successful than shipping the eggs and hatching them at Lacombe.

[*Feeding experiments*].—Twenty cockerels averaging 3.62 lbs., fed in a crate for 10 days, gained an average of 0.92 lb. as compared with gains of 0.47 lb. by a like number of birds averaging 4 lbs. which had access to a limited run. The rations consisted of a moist mash of oat chop and buttermilk.

The feed costs of raising two lots of green ducks to 8 weeks of age, at which time they averaged 4.5 and 4.25 lbs., respectively, are reported. The average costs were calculated at 7.5 and 7 cts., respectively, for the first 4 weeks and 18.3 and 18.4 cts. for the second 4 weeks.

[*Poultry investigations at the Sidney Experimental Station*], E. M. STRAIGHT (*Canada Expt. Farms, Sidney (B. C.) Sta. Rpt. Supt. 1922, pp. 50-63, figs. 2*).—The results of the year's work includes experiments on the feeding and raising of poultry in addition to the results of the following tests:

*Comparison of various systems of incubation.*—The following percentages of fertile eggs were hatched in different makes of artificial incubators: Queen 65, Buckeye 51, and Jubilee 74 per cent. Sixty-five per cent of the fertile eggs incubated by hens hatched.

*Hatching results—hens v. pullets.*—In this test 65.6 per cent of the fertile eggs laid by hens hatched as compared with only 37.25 per cent of the fertile eggs laid by pullets.

*Incubation—March, April, May.*—A comparison of the hatching percentages of eggs set in the different months showed that 63 per cent of the fertile eggs hatched in March, 55 per cent in April, and 67 per cent in May. Of the chicks



hatched, 66 per cent of those born in March were alive on July 1 as compared with 42.5 per cent of the April chicks and 28.5 per cent of the May chicks.

*Effect of three weeks' crate feeding on pullets for winter layers.*—Pullets crate fed for three weeks laid less eggs during the winter and during the entire year than others fed dry mash by the usual methods. The crate-fed lots started laying an average of three days earlier, however.

*Cost of [egg] production, March, April, and May hatched pullets, 1921-22.*—Lots of pullets hatched in March, April, and May were found to lay an average of 173, 188, and 186 eggs per bird, respectively, during the year 1921-22, but due to the fact that more eggs were laid when prices were high the May hatched birds made greater profits.

The grain and dry mash required per dozen eggs varied from 4.62 to 6.29 lbs. during the years 1919 to 1922. The months of highest cost were November, December, November, and October in the respective years, and the months of lowest cost were June, February, April, and May.

*Relation between weight of layers at end of year and production.*—The relation between the weights of hens and their production was studied in 1921 and 1922. It was found that the birds under 4.5 lbs. produced an average of 190.3 eggs, from 4.5 to 5 lbs. 196.5 eggs, from 5 to 5.5 lbs. 208.8 eggs, from 5.5 to 6 lbs. 197 eggs, and over 6 lbs. 210.7 eggs.

*Efficiency and accuracy of various types of trap nests.*—Records of the time per bird required to operate various types of trap nests varied from 10.1 to 15.1 seconds. Variations in the accuracy of the types were also observed.

*Confinement v. range.*—A confined pen of birds laid more eggs during the year than a pen which had free range, but the feed costs were very much greater. The pen receiving range laid a few more eggs during the winter, however. In comparing the hatching and rearing of the eggs and chicks from the range and confined birds, it was found that 60 of the 192 eggs set from the range lot and 48 of the 186 eggs set from the confined birds hatched. Twenty-six of the chicks from the range lot were alive on July 1 as compared with 11 from the confined lot.

*Commercial feeds v. home mixed Sidney rations.*—Hens laid more eggs on a home mixed ration than on a commercial feed, but they also ate more and the cost of the eggs was, therefore, greater.

**Practical poultry raising**, J. R. TERRY (*Brit. Columbia Dept. Agr. Bul. 26, 7. ed. (1922), pp. 37, figs. 26*).—This is a brief manual for the poultry raiser.

**Variation and correlations of the organs of Single Comb White Leghorn cockerels**, A. J. SOUBA (*Anat. Rec., 26 (1923), No. 4, pp. 291-296, pl. 1*).—The mean weights, standard deviation, coefficients of variation, and probable errors of each of the organs studied in the investigation previously noted (*E. S. R., 49, p. 569*) for the lots of birds receiving the normal poultry ration and the normal synthetic ration are given. Correlation coefficients between the body weights and weights of the different organs varied from  $0.521 \pm 0.05$  to  $0.801 \pm 0.024$ . Correlations between the weight of testes and comb and for the length of testes and comb corrected for the body weight were high, and indicated that from a knowledge of the body weight and development of the comb one could predict the sexual development of the cockerels.

**The prediction of egg records**, G. W. HERVEY (*New Jersey Stat. Bul. 389 (1923), pp. 5-20, figs. 10*).—This is a more detailed report of the results of the statistical study previously noted (*E. S. R., 50, p. 72*). In addition to the information given there, the variations in the annual and seasonal egg production

are shown graphically and in tabular form, and correlation coefficients are given as shown in the following table:

*Correlation coefficients between seasonal and annual egg production.*

Production periods correlated.	Coefficient of correlation.
Winter first year and total first year.....	0. 7752±0. 0132
Spring first year and total first year.....	. 5359± . 0235
Summer-fall first year and total first year.....	. 7680± . 0135
Winter second year and total second year.....	. 5486± . 0231
Spring second year and total second year.....	. 6603± . 0186
Summer-fall second year and total second year.....	. 8548± . 0101
Winter first year and winter second year.....	. 3984± . 0278
Spring first year and spring second year.....	. 3387± . 0292
Summer-fall first year and summer-fall second year.....	. 5176± . 0242
Winter first year and total second year.....	. 3388± . 0292
Spring first year and total second year.....	. 2924± . 0302
Summer-fall first year and total second year.....	. 4747± . 0256
Total first year and total second year.....	. 5162± . 0243

A correlation coefficient of only  $0.0571 \pm 0.0231$  was found between the first year production of dams and the average first year production of their daughters, thus indicating practically no relationship between the mass production of dams and daughters.

**The nutritional requirements of baby chicks.**—III, *The relation of light to the growth of the chicken*, E. B. HART, H. STEENBOCK, and S. LEPKOVSKY (*Jour. Biol. Chem.*, 58 (1923), No. 1, pp. 33-41, pls. 2).—In continuing this series (E. S. R., 47, p. 871), the relation of light to growth has been studied by feeding five lots of 8 chicks each on a ration of white corn, skim milk, and a salt mixture. One lot received no direct sunlight, one lot received sunlight all day, other lots received 10 minutes and 1 hour of sunlight, respectively, and the fifth lot was radiated 10 minutes daily with a quartz mercury vapor lamp. The chicks receiving no sunlight died in less than 6 weeks, averaging about 100 gm. in weight. With all-day sunlight the birds kept in much better condition and the 5 living at 8 weeks of age averaged 250 gm. The other groups were intermediate in condition and size, the relative position depending upon the amount of sunlight received.

In another experiment 8 Barred Rock chicks without sunlight were fed a synthetic diet supplemented with fresh green clover equivalent to 5 per cent of their ration. After 23 days of feeding it was observed that normal growth was not being made, and therefore 2 of the chicks were exposed to sunlight  $\frac{1}{2}$  hour daily, after which excellent growth occurred.

**Natural and artificial brooding of chickens**, A. R. LEE (*U. S. Dept. Agr., Farmers' Bul.* 1376 (1924), pp. II+17, figs. 12).—This is a revised edition of *Farmers' Bulletin* 624 (E. S. R., 32, p. 264).

**Wet litter in the poultry house**, A. B. DANN (*Poultry Sci.*, 3 (1923), No. 1, pp. 15-19).—This is a discussion of the amounts of the water that must be evaporated from the litter in the henhouse to keep it dry, with suggestions as to the different agencies which aid in maintaining dry litter.

## DAIRY FARMING—DAIRYING.

**Dairying**, G. FASCETTI (*Caseificio*. Milan: Ulrico Hoepli, 1923, 3. ed., enl., pp. XXXII+727, figs. 117).—This is a revised and enlarged edition of the book previously noted (E. S. R., 42, p. 269) dealing with the history, development,



and science of dairying; the analysis, hygiene, and preservation of milk; market milk for cities; cream, butter, and cheese manufacturing; dairy organizations; and an appendix dealing with laws and regulations governing the sale and manufacture of dairy products.

**Thirty-sixth annual report of the Swiss Dairy Association and its sections for 1922** (*Jahresber. Schweiz. Milchw. Ver.*, 36 (1922), pp. 199, pl. 1).—This volume contains the 1922 report of the Swiss Dairy Association and the committees appointed, as well as a report of the activities of the different subordinate sections.

[**Experiments with dairy cattle at the Kentville Experimental Station**], W. S. BLAIR (*Canada Expt. Farms, Kentville (N. S.) Sta. Rpt. Supt. 1922*, pp. 6-11).—The results of the following experiments are briefly reported:

**Butterfat content of milk at different periods of lactation** (pp. 6-8).—The average daily milk yields and fat percentages are given by months for four cows during five to eight successive lactations. The butterfat content of the milk of the individual cows was found to be rather constant at the different ages and during different periods of the year.

**Calf feeding experiment** (pp. 9-11).—Three lots of five calves each raised on whole milk, skim milk, and by suckling the cows were compared as to the amount and cost of additional feeds for raising and the weights at six months of age. The average weights attained were 425, 399, and 357 lbs. by the suckled, whole milk, and skim milk calves, respectively, and the calculated feed costs per pound of gain were 14.69, 20.1, and 7.26 cts., respectively.

**The care of calves**, A. RIVERA (*Porto Rico Dept. Agr. and Labor Sta. Circ. 67* (1923), *Spanish ed.*, pp. 7).—This is a popular discussion of the care, management, feeding, and diseases of calves and young stock.

**The minimum milk requirement for calf raising**, A. C. RAGSDALE and C. W. TURNER (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 9, pp. 437-446, fig. 1).—The complete results are given of experiments at the Missouri Experiment Station in which a total of 30 dairy calves were raised during 1919, 1920, 1921, and 1922 on a minimum amount of milk. The height and weight increases and the feeds consumed are tabulated for each animal. A briefer account of this work has been noted from another source (*E. S. R.*, 48, p. 669).

**Investigations on the average composition of Danish cows' milk**, A. C. ANDERSEN and P. V. F. P. LANGMACK (*Beret. Forsøgslab. K. Vet. og Landbohøjskoles [Denmark]*, 113 (1923), pp. 5-37, figs. 4).—Based on the determination of the composition of cows' milk made over a period of three years, the authors found the average composition to be of fat  $3.521 \pm 0.023$  per cent, protein  $3.167 \pm 0.012$  per cent, and water  $87.638 \pm 0.032$  per cent. The composition is also reported in tabular form for each month during the three years from August, 1919, to July, 1922, and for the three winter months, January, February, and March, during 1919 and 1923. The yearly average for milk sugar is also given.

**On the producing of milk having a low bacterial content**, W. SADLER, C. D. KELLY, and G. R. MARTIN (*Sci. Agr.*, 4 (1924), No. 6, pp. 173-179, figs. 3).—The bacteriological conditions of both morning and evening milk produced on a dairy farm having only fair equipment were studied at the University of British Columbia from April 10 to July 24, 1923. A milking machine was used which was sterilized only after the morning milking from April 10 to June 6, but twice daily from June 6 to July 24, inclusive. The average bacterial counts as determined on bacto-purple-lactose-agar varied from about 2,000 to 4,000 per cubic centimeter, showing that milk low in bacterial count could be produced under conditions not particularly adaptable when the dairymen



were careful. Reductase tests, fermentation tests, and tests for gas-producing organisms also indicated that the milk was of very good quality.

**Report of the proceedings of the national milk conference on pasteurization, 1923** (London: Natl. Clean Milk Soc., Inc., [1924], pp. IX+85+X-XV).—The report of the British national milk conference on pasteurization, held in November, 1923, is given. In addition to the general discussions, papers were presented dealing with the methods and processes of pasteurization, by R. Seligman; physical, chemical, bacteriological, and biochemical changes occurring during pasteurization, by A. T. R. Mattick, S. B. Schryver, J. M. Beattie, and F. G. Hopkins, respectively; and the financial and commercial aspects of pasteurization, by J. H. Maggs.

**Studies on butter making**, U. PRATOLONGO (*Gior. Chim. Indus. ed Appl.*, 6 (1924), No. 1, pp. 3-10, figs. 4).—From the results of experiments carried on in the Agricultural and Industrial Chemical Laboratory of the School of Agriculture at Milan, Italy, the author has discussed the physical and chemical properties of butterfat with relation to the formation of butter during churning. The effect of temperature and the length of time necessary for churning were also especially considered.

**Comparison of woods for butter boxes**, G. D. TURNBOW (*California Sta. Bul.* 369 (1923), pp. 10, figs. 5).—The results are reported of a series of experiments in comparing the flavor and odor absorbed by butter when stored for six months in containers of white fir, cottonwood, and spruce. The comparisons were made with wood which was unseasoned, which was seasoned and paraffined, and which was seasoned, paraffined, and lined with parchment paper.

As a result of this study it was concluded that white fir and cottonwood can be used in place of spruce but that the boxes should be paraffined, and it is desirable that they be lined with parchment paper.

In other tests the same woods were used in making boxes for storing butter in cubes. The results given were very similar for the three woods, and they also indicated that either the wood should be lined with parchment paper or that the butter should be wrapped. The slight differences observed, however, indicate that cottonwood is not quite as satisfactory as spruce or white fir, due to a slight absorption of the flavor by the butter.

**Quality studies bring forth interesting facts**, P. H. TRACY (*Ice Cream Trade Jour.*, 20 (1924), No. 2, pp. 73-76; also in *Creamery and Milk Plant Mo.*, 13 (1924), No. 2, pp. 77, 78, 80, 82).—The results of several experiments, dealing with factors affecting the quality of ice cream at the Illinois Experiment Station, indicate that increased acidity tends to reduce viscosity but has practically no uniform effect on overrun. Over 0.2 per cent acidity tended to injure the flavor. In other studies the amount of overrun necessary to produce the best quality in ice cream varied with the composition, that containing more fat apparently being of the best texture and showing the most resistance with a greater overrun than that containing less fat.

The use of dehydrated egg yolk was investigated with somewhat variable results. The general conclusions were that a small amount may improve the quality of the product but that the same results would follow the use of more milk solids.

**A study of the factors affecting the size and shape of air cells in the freshly frozen and hardened product**, A. C. DAHLBERG (*Ice Cream Trade Jour.*, 20 (1924), No. 2, pp. 68-70, figs. 4).—A more detailed report of studies previously noted (E. S. R., 50, p. 580).

**Benefits of homogenization in ice cream making**, O. E. WILLIAMS (*Ice Cream Trade Jour.*, 20 (1924), No. 1, pp. 63, 64, figs. 3; also in *Creamery and Milk*



*Plant Mo.*, 13 (1924), No. 2, pp. 84-86, figs. 3).—This is a discussion of the improvements which may be brought about in ice cream by homogenization, which reduces the size of the fat globules, thus making a more uniform product of better quality.

**The ice cream mix**, A. C. BAER, N. E. OLSON, and A. D. BURKE (*Milwaukee, Wis.: Olsen Pub. Co.*, 1923, pp. 75+XVI).—Formulas for ice cream mixes of varying compositions and instructions for standardizing an ice cream mix are given, as well as a chapter on gelatin and a summary of the State laws and regulations relating to ice cream.

**A graphical method for figuring complex ice cream mixes**, H. H. SOMMER (*Ice Cream Rev.*, 7 (1923), No. 5, pp. 54, 56, 58, figs. 4).—A graphical method of calculating the ice cream mix used successfully at the Wisconsin Dairy School is described.

## VETERINARY MEDICINE.

**Laboratory studies in tropical medicine**, C. W. DANIELS and H. B. NEWHAM (*London: John Bale, Sons & Danielsson, Ltd.*, 1923, 5. ed., rev., pp. XIII+576, pls. 8, figs. 183).—This is a fifth, thoroughly revised edition of the work previously noted (*E. S. R.*, 42, p. 174).

**Annual administration report of the Civil Veterinary Department, Madras Presidency, for 1922-23**, F. WARE ET AL. (*Madras Civ. Vet. Dept. Ann. Admin. Rpt.* 1922-23, pp. 22).—This is the usual annual report (*E. S. R.*, 48, p. 480).

**The mast cell in the lower vertebrates**, N. A. MICHELS (*Cellule*, 33 (1923), No. 2, pp. 337-462, pls. 6).—This report of studies is accompanied by a bibliography of nine pages.

**The male as a spreader of genital infections**, W. L. WILLIAMS (*Jour. Amer. Vet. Med. Assoc.*, 63 (1923), No. 3, pp. 281-316, figs. 25).—This is an extended discussion of the subject, in which the part played by the male in the spread of infection is considered.

**On the inheritance of acquired antibodies**, J. R. LEARMONTH (*Jour. Hyg. [London]*, 22 (1923), No. 1, pp. 100-106).—The literature on the subject is reviewed, and experiments are reported in which *Bacillus typhosus* was used to create immunity in parent guinea pigs and tests were made of the agglutination titer of their serum and of the serum of the young immediately after birth. Nonimmunized and immunized males were mated both to immunized and nonimmunized females.

The blood of the offspring of nonimmunized males and females and of immunized males and nonimmunized females showed no agglutinins, thus furnishing additional proof that immunity is not transferred by the males. Agglutinins in varying amounts were found in the serum of the young of immunized females even before the ingestion of colostrum. The titer in some cases equaled and in some exceeded that of the maternal serum. No quantitative relationship between the two could be noted.

"The actual type of fetal immunity of this kind must remain for the present undetermined. Experimental observations, and especially those of a quantitative nature, will vary widely with the dependence of the young upon colostrum, with individual peculiarities in the reacting power of the animals, and with the behavior of the antigens used."

**Duration of passive immunity, II-IV**, A. T. GLENNY and B. E. HOPKINS (*Jour. Hyg. [London]*, 22 (1923), Nos. 1, pp. 12-51, figs. 14; 2, pp. 208-221, figs. 5).—Continuing the investigation previously noted (*E. S. R.*, 49, p. 478), three papers are presented.

Part 2 deals more fully with the differences exhibited by normal rabbits toward the injection of diphtheria antitoxin. Marked differences were noted in the duration of the second phase, phase B, of loss of immunity, and in the duration and intensity of the third phase, phase C. The latter, which is due to the formation of precipitin, occurred sooner and was more pronounced in the older animals. The differences shown by normal rabbits are thought to indicate naturally acquired immunity of varying degrees.

In further experiments in which injections of antitoxic serum were made subcutaneously instead of intravenously, the highest concentration in the blood was noted after from two to three days. It had then reached approximately the same value as that of rabbits injected intravenously, representing only one-third of the total antitoxin injected.

In part 3 the investigation was extended to other normal animals injected with horse serum, normal rabbits injected with serum from other animals than the horse, and animals injected with homologous antitoxin, the same methods being employed as in the earlier studies. The results are summarized as follows:

"The course of disappearance of passive immunity in rabbits injected with diphtheria antitoxin obtained from goats, men, guinea pigs, and cows, consists of the same three phases that follow the injection of horse serum. The rabbits examined were more responsive to goat, human, and guinea pig serum than to horse and cow serum.

"The course of disappearance of passive immunity in rabbits, horses, and guinea pigs injected with homologous antitoxin consists of phases A and B only, and phase B is far slower than when heterologous serum is injected into rabbits.

"Sheep and goats eliminate antitoxin obtained from a horse at a very slow rate, and phase C is hardly detectable.

"Natural immunity of horses to diphtheria toxin is gradually acquired by a number of increasing responses to external stimuli."

Part 4 deals with the rate of disappearance of antitoxic horse serum after injection into rabbits previously sensitized to horse serum. Evidence was obtained that rabbits can be immunized actively to horse serum by amounts as small as 0.00001 cc., but in the immunizing experiments reported larger amounts were used. Following injection of antitoxic serum into immunized rabbits at intervals of from 3 to 10 weeks the antitoxin was eliminated at rapidly increasing rates. In one case a rabbit given serum intravenously 6 days after a previous injection lost over 99 per cent of the antitoxin within 15 minutes. When antitoxic serum was injected intravenously into rabbits at weekly intervals, less than 2 per cent of the amount injected could be detected 24 hours after each injection. After 12 daily intravenous injections the antitoxic content was only half that of the first injection, but later injections were not eliminated so quickly. The rate of elimination of antitoxic serum was greatly delayed by daily injections of normal horse serum.

**The application of experimental methods to epidemiology, L. T. WEBSTER** (*Amer. Jour. Hyg.*, 4 (1924), No. 2, pp. 134-142, figs. 10).—This is essentially a summary of the results obtained in the series of studies on experimental epidemiology conducted at the Rockefeller Institute of Medical Research by the author and other investigators (*E. S. R.*, 50, p. 478) and of a similar investigation conducted in England by Topley (*E. S. R.*, 49, p. 584), together with a statement of the theory which has been formulated as a result of this work to account for epidemics of mouse typhoid in particular and human intestinal diseases in general. The hypothesis is stated as follows:



"The bacilli of the paratyphoid-enteritidis group are widely present throughout the animal kingdom. Those pathogenic for laboratory mice tend to an endemic distribution. Some of the disease-producing strains are highly virulent, others less so. Virulent strains come into being by some means more subtle than animal passage. Upon the grade of virulence of each strain will depend the peak height of the mortality curve and the ability of that strain to induce an epidemic in a population of known susceptibility. When a virulent strain is distributed suddenly throughout an entire community in adequate available quantities, a single epidemic mortality curve results, the form of which will depend not upon fluctuations in microbial virulence, but wholly upon the degree of and differences in susceptibility of the individuals composing the population. In an experimentally controlled normal mouse community these differences are chiefly those of individual nonspecific resistances; in a more general community, racial and acquired resistances also come into operation. Differences in speed and extent of distribution of the bacilli affect the form of the curve and produce gross irregularities such as multiple peaks and plateaus."

**Studies on metabolism of anaerobic bacteria, I, II** (*Jour. Infect. Diseases*, 34 (1924), No. 1, pp. 63-102, figs. 6).—Two papers are presented.

I. *Comparative study of growth and biochemical activities of Bacillus botulinus, B. sporogenes, and B. tetani, with notes on chemical behavior of B. botulinus type C*, E. Wagner, C. C. Dozier, and K. F. Meyer (pp. 63-84).—Pure cultures of *B. botulinus* type A, *B. sporogenes*, and *B. tetani* were grown from the spore stage on a peptic digest-beef heart infusion and analyses made from time to time of the nitrogen distribution and of volatile and nonvolatile acids.

The cultures of *B. botulinus* and *B. sporogenes* were similar in their ammonia and amino acid nitrogen formation, in their ability to utilize creatinin, in their gas formation, and in the formation of acids of high molecular weight. The cultures of *B. tetani* were characterized by a more marked accumulation of ammonia and smaller accumulation of amino acid nitrogen, complete utilization of creatinin, smaller formation of gas, and a greater accumulation of volatile acids, chiefly acetic. Practically equal amounts of fixed acids were formed in the three cultures.

*B. botulinus* type C showed little chemical activity in the medium used.

II. *Effect of glucose on biochemical activities, including growth and toxin production of B. botulinus*, C. C. Dozier, E. Wagner, and K. F. Meyer (pp. 85-102).—Determinations at short successive intervals of time are reported of the toxin titers, chemical composition, and number of viable organisms in *B. botulinus* inoculated media of high biological value, differing only in their content of utilizable carbohydrate.

The presence of glucose appeared to stimulate early reproduction, to increase the maximum number of viable organisms, and to maintain a higher level of growth throughout the experimental period. After the thirty-sixth hour there was a gradual loss of ammonia in the medium containing glucose in contrast with a continuous increase in the glucose-free culture. While there was a gradual increase in amino acid nitrogen in both cultures, the total amount on the ninety-sixth hour was greater in the medium containing glucose. Both media contained about the same amount of volatile acids, but there was a greater amount of fixed acids in the glucose-free medium. The total amount of gas produced was higher by about 33 per cent in the medium containing glucose.

There was no appreciable difference in the amount of toxin formed in both media. This is thought to afford additional proof that botulinus toxin is an autolytic product.

**The nutrition of bacteria, with special reference to *Bacillus influenzae* (Pfeiffer),** S. S. SHRI KENT (*Jour. Hyg. [London]*, 22 (1923), No. 1, pp. 52-68, pl. 1).—The results obtained and conclusions drawn in this study of the nutritive requirements of *B. influenzae* (Pfeiffer) confirm in general those of Davis (E. S. R., 46, p. 80) and of Thjötta and Avery (E. S. R., 46, p. 78).

Rabbit blood in 1:100,000 dilution was found to enable *B. influenzae* to grow in a plain broth medium, pH=7.6. The extreme dilution of the blood is thought to indicate that the hemoglobin acts as a catalyst instead of a nutritive agent in the strict sense of the word. A further study of the various constituents of the blood confirms the observation of Thjötta and Avery that two substances are essential, one of which is resistant and the other not resistant to heat.

The growth-promoting factors in blood were found to be present in bacterial products and in fresh animal and vegetable tissues. For the latter, potato, turnip, banana, and apple were used. Of these, potato appeared to be the most active, followed by the others in the order given. It is concluded that "these growth-inducing bodies comprise a large group of substances, occurring in blood, in bacterial products, in animal, and in vegetable tissues. Probably the nature varies with the source, but they all seem to have certain properties in common, and they all act as substances accessory to the other food constituents. Their mode or mechanism of action is not understood, and their chemical nature not known, the criteria for their identification being so inadequate. It is suggested that the growth-stimulating properties are related to the presence of certain oxidizing and reducing enzymes in fresh plant tissues, as well as to the presence of vitamins."

**Complement fixation studies on *Clostridium botulinum*,** W. A. STARIN and G. M. DACK (*Jour. Infect. Diseases*, 34 (1924), No. 2, pp. 137-147).—Using the same cultures as those of the previous study on agglutination (E. S. R., 49, p. 881), the authors have investigated the reliability of the complement fixation test for differentiating strains of *C. botulinum* and for identifying contamination in canned vegetables by this organism.

In the first part of the investigation, the only antigen giving satisfactory results consisted of single cell strains dissolved by alternate freezing and thawing. These had a high antigenic value and showed no anticomplementary action. Using antigens thus prepared, it was possible to demonstrate the presence of complement-fixing bodies in the serum of animals immunized with the same strains. It was also possible to demonstrate the same four subgroups within type A and three within type B corresponding to those determined by the agglutination reactions in the previous study.

In the second part of the investigation the method employed by Kelser (E. S. R., 50, p. 64) was used. It was found that vegetables inoculated with *C. botulinum* contained antigens capable of being detected by the complement fixation reaction. These could be demonstrated within 60 hours after inoculation and were still present after 8 weeks in vegetables kept at room temperature. No differentiation between types A and B was possible, and there was considerable difficulty in carrying out the tests on account of nonspecific reactions. In consequence of this, the test is not considered particularly reliable.

**Bird migration in relation to foot-and-mouth disease,** A. L. THOMSON (*Nature [London]*, 113 (1924), No. 2828, pp. 52-54).—This is a discussion of in-



vestigations of the transmission of this disease in Great Britain, particularly as relates to the investigations of Stockman and Garnett, previously noted (E. S. R., 50, p. 380).

**The occurrence of peroxid in cultures of pneumococcus,** O. T. AVERY and H. J. MORGAN (*Jour. Expt. Med.*, 39 (1924), No. 2, pp. 275-287, fig. 1).—The formation of peroxid has been demonstrated under favorable conditions in broth cultures of 15 out of 23 strains of *Streptococcus hemolyticus* and 1 of 3 strains of *S. mucosus*, but could not be detected in similar cultures of 2 strains of *Staphylococcus aureus*. The conditions which favored the accumulation of peroxid in the culture medium were found to be free access of air and the absence of catalase or other catalysts capable of decomposing peroxid. In cultures with deficient oxygen exposure there was delayed production of peroxid, and in anaerobic conditions there was no evidence of its formation. The amount of peroxid formed is thought to depend upon the balance between the amount produced by the various organisms and the amount destroyed by substances in the medium.

The peroxid as thus formed disappears gradually on incubation at 37° C., is less stable in alkaline than in neutral or acid media, and is destroyed at the temperature of boiling water for 15 minutes and at that of steam under pressure for 10 minutes.

**Homologous and heterologous protection in mice vaccinated with the two types of mouse typhoid bacillus,** I. W. PRITCHETT (*Jour. Expt. Med.*, 39 (1924), No. 2, pp. 265-273, figs. 2).—In immunization experiments conducted on mice with vaccines prepared from the two strains of mouse typhoid bacilli M. T. I and M. T. II isolated by Lynch during the course of two mouse typhoid epidemics at the Rockefeller Institute for Medical Research (E. S. R., 48, p. 83) and further studied by Webster, Amoss, et al. (E. S. R., 48, p. 84), it was found that a saline vaccine prepared from the strain of M. T. II protected against the same strain and to a slight degree against M. T. I, while two vaccines prepared from strain M. T. I afforded no protection against either strain.

**Eradication of tuberculosis in cattle at the Kodiak Experiment Station,** C. C. GEORGESON and W. T. WHITE (*Alaska Stas. Bul.* 5 (1924), pp. 11, figs. 2).—Following a preliminary account in which the introduction of cattle into Alaska is discussed, the authors deal with the occurrence of tuberculosis in the station cattle and the eradication work which has been successfully conducted.

"From 1916 to 1921, inclusive, 140 head of cattle were tested one or more times at the Kodiak Experiment Station. Of 35 head which reacted to the tuberculin test, 8 head were classed as suspicious on the first or second test. Two head which were first classed as suspicious were later pronounced healthy and turned in with the healthy herd. All healthy animals were segregated at once and placed in disinfected quarters. All reactors and suspicious animals were removed to Kalsin Bay, 15 miles from the healthy herd, and each lot was kept in separate quarters. A well-bred reacting bull was placed at the head of the reacting herd of females, and breeding continued as under normal conditions. Females showing clinical symptoms of disease were slaughtered. Reactors had the appearance of being normal, healthy animals in every respect for months. Eventually, however, they developed clinical symptoms of tuberculosis. Thirty calves were dropped by the tuberculous herd from 1917 to 1920, inclusive. These calves were raised on pasteurized milk which was taken from the tuberculous mothers. When old enough they were tested and upon being pronounced healthy were added to the sound herd.



"Breeder of purebred cattle probably will not retain reactors for breeding, even though the affected animals are valuable. The experiment proves, however, that highly prized reactors need not be slaughtered. They can not be cured, but they can be isolated and bred for the production of healthy offspring."

**Preliminary essentials to bovine tuberculosis control in California**, G. H. HART (*California Sta. Circ.* 264 (1923), pp. 8, figs. 3).—This is a discussion of the subject as applied to California conditions.

**The pathology of sterility in cattle**, W. L. BOYD (*Jour. Amer. Vet. Med. Assoc.*, 63 (1923), No. 5, pp. 561–579, figs. 14).—This is a discussion relative to those changes which occur in the reproductive organs of the female.

**A sporadic outbreak in cattle resembling tetanus**, R. L. CONKLIN and E. G. HOOD (*Jour. Amer. Vet. Med. Assoc.*, 63 (1923), No. 3, pp. 327–333, figs. 5).—This is an account of an outbreak of a disease which caused serious losses during the past two years among Ayrshire cattle on a farm located in the eastern part of the Province of Quebec. Twelve animals were lost in the herd in 1921 and 16 in 1922, and previous years are said to have shown about the same rate of mortality. The initial loss from the outbreak is said to have been estimated at approximately \$15,000. An organism showing the greatest similarity to *Bacillus tetani* and the pseudo-tetanus group was isolated and has been given the provisional name *B. suberis*.

**Mutation among hog cholera bacilli**, M. L. ORCUTT (*Jour. Expt. Med.*, 38 (1923), No. 1, pp. 9–15).—This is a report of studies conducted by the department of animal pathology of the Rockefeller Institute for Medical Research, at Princeton, N. J. The conclusions arrived at are as follows:

"In the hog cholera group the mutation from smooth (A) to granular (B) type occurs, and a mutant with a moist, opaque colony formation was noted. The B mutant when obtained pure remains a B type without reversion in the stock cultures. The B mutant can be made to assume some of the A characters by rapid successive transplanting in bouillon. The B mutant can usually be found in older transplants of A. The two types may be distinguished by certain cultural characters, by slightly different agglutination reactions, and by different degrees of virulence."

**An epizootic of aspergillosis in chickens**, J. E. GUBERLET (*Jour. Amer. Vet. Med. Assoc.*, 63 (1923), No. 5, pp. 612–620).—This is a contribution from the Oklahoma Experiment Station, which reports upon an epidemic of aspergillosis that was prevalent in the flocks of poultry raisers in the vicinity of Stillwater, Okla., in the spring of 1922.

"The predisposing causes are a lowered vitality and weakened resistance from some cause or other. In this instance the primary cause was due to the nutritional condition of the birds, in addition to having been fed moldy feed in closely confined pens. Treatment is of no value after the birds once show symptoms. Prevention lies in allowing free range, plenty of green feed, and clean pens and feed. *Aspergillus fumigatus* grows very readily on bread, potato, and beer-wort agar. Experiments show that the fungus is not particularly pathogenic in healthy, active birds, but that once it finds suitable conditions for growth its virulence increases."

**Canned goods preserved with boric acid poisonous to chickens**, B. A. GALLAGHER (*North Amer. Vet.*, 5 (1924), No. 3, pp. 125, 130).—This contribution from the U. S. D. A. Bureau of Animal Industry reports experimental work in which a commercial compound containing 95 per cent of boric acid and 5 per cent of innocuous material was used. Of two lots of string beans prepared by the U. S. D. A. Bureau of Chemistry, one lot received the boric acid compound in the amount directed by the manufacturers, namely, 9 gm. of



boric acid to 1 qt. of canned string beans, while the other lot, prepared by the cold-pack method, contained no preservative of any kind and was used as a check. The results show that canned goods prepared for human consumption with the addition of a boric acid preservative in the amount stated are poisonous to chickens, and that the birds will not eat such preserved food after the first experience. When feeding is forced on the fowls, extensive inflammation and necrosis of the crop, stomach, and intestine are induced as a result of the irritant and poisonous action of the canning compound, and death results.

## RURAL ENGINEERING.

**Summary of hydrometric data in Washington, 1878-1919**, G. L. PARKER and L. LEE (*U. S. Geol. Survey, Water-Supply Paper 492* (1923), pp. VIII+363, pls. 9).—This report, prepared in cooperation with the Washington State Board of Geological Survey, summarizes the hydrometric data obtained in the State of Washington from March, 1878, to September, 1919. Records of 1,120 years of stream flow are made available from 209 gauging stations. The details of this data are contained in 45 different volumes published by the U. S. Geological Survey, most of which have been noted from time to time in the *Record*.

**Surface water supply of St. Lawrence River basin, 1921** (*U. S. Geol. Survey, Water-Supply Paper 524* (1923), pp. IV+112, pls. 2).—This report, prepared in cooperation with the States of Wisconsin, New York, and Vermont, contains the results of measurements of flow made on streams in the St. Lawrence River basin during the year ended September 30, 1921.

**Surface water supply of Hudson Bay and upper Mississippi River basins, 1919-1920** (*U. S. Geol. Survey, Water-Supply Paper 505* (1923), pp. V+287, pls. 2).—This report, prepared in cooperation with the States of Minnesota, Wisconsin, Iowa, and Illinois, presents the results of measurements of flow made on streams in these drainage basins during the years ended September 30, 1919 and 1920.

**Surface water supply of South Atlantic slope and eastern Gulf of Mexico drainage basins, 1919 and 1920** (*U. S. Geol. Survey, Water-Supply Paper 502* (1923), pp. IV+80, pls. 2).—This report presents the results of measurements of flow made on streams in these drainage basins during the years ended September 30, 1919 and 1920.

**Surface water supply of western Gulf of Mexico basins, 1921** (*U. S. Geol. Survey, Water-Supply Paper 528* (1923), pp. IV+96, pls. 2).—This report, prepared in cooperation with the State of Texas, presents the results of measurements of flow made on streams in the western Gulf of Mexico drainage basins during the year ended September 30, 1921.

**Surface water supply of Pacific slope basins in California, 1919 and 1920** (*U. S. Geol. Survey, Water-Supply Paper 511* (1923), pp. VII+456, pls. 2).—This report, prepared in cooperation with the States of California and Oregon, contains records of measurements of flow made on streams in the Pacific slope basins in California and the Klamath River basin in Oregon during the years ended September 30, 1919 and 1920.

**The hydraulic ram**, W. S. H. CLEGHORNE (*Queensland Agr. Jour.*, 20 (1923), No. 6, pp. 414-421, figs. 8).—Information, including graphic and tabular data, on the design and installation of hydraulic ram outfits is presented.

**The relation of highway research to modern road construction**, A. T. GOLDBECK (In *Lectures on Engineering Practice*. Baltimore: Johns Hopkins Press, 1923, pp. 9-48, figs. 20).—This is essentially a description of a number of the primary researches being conducted by the U. S. D. A. Bureau of Public



Roads and a brief discussion of the relation they bear to the design and construction of highways.

**Highway research in Illinois**, C. OLDER (*Amer. Soc. Civ. Engin. Proc.*, 50 (1924), No. 2, [pt. 3], pp. 175-217, figs. 26).—A description is given of a series of research projects planned to get an insight into and understanding of the unsolved problems of rural pavement design. The principal problems under investigation include the drainage of subgrade soils, the effect of repeated bearing pressures on soils, the effect of temperature changes on pavement surfaces, the position of wheel loads as affecting stresses in pavement slabs, impact resulting from moving wheel loads, and the fatigue effect of repeated loads causing bending stresses in plain concrete. The data obtained from a test road so constructed as to eliminate the variable factor of subgrade bearing power are also summarized.

The impact tests yielded results obtained for wheel loads of 4,000, 6,000 and 8,000 lbs., dropping  $\frac{1}{8}$ ,  $\frac{1}{4}$ ,  $\frac{3}{8}$ , and  $\frac{1}{2}$  in. at truck speeds varying from about 1 to about 20 miles per hour with constant unsprung weight. The results showed that for all heights of drop the equivalent static load or the deflection at the critical point with an increase in speed decreased to a certain minimum, then increased more or less gradually. In amount, this reduction in equivalent static load showed a distinct tendency to increase with the increase of load above the springs. This was especially true in all cases of dropping load and to a less degree for the  $\frac{1}{8}$ - and  $\frac{1}{4}$ -in. vertical rises. The differences between the minimum and maximum equivalent static load was not greatly affected by the change in load. For all heights of drop this resulted in a lowering of the impact factor.

At all speeds for the  $\frac{1}{8}$ -in. drops and the  $\frac{1}{8}$ -in. rises with the truck fully loaded, the equivalent static load was less than the static load of the wheel. For the  $\frac{1}{4}$ -in. drops with the truck fully loaded, the equivalent static load was less than the truck wheel load until the speed of the truck exceeded about 12 miles per hour, and did not increase materially for speeds in excess of 14 miles per hour. The maximum equivalent static load for the 8,000-lb. wheel load was only a little greater than the wheel load itself. In mounting the  $\frac{1}{4}$ -in. obstruction the critical speed was about 10 miles per hour, and the equivalent static load did not increase materially for speeds in excess of 14 miles per hour. For the drops and rises of greater magnitude the critical point was passed at lower speeds, and the maximum impact effect was much greater.

Data on the warping of rigid pavement slabs due to temperature changes are considered to confirm the belief that rigid pavement slab corners frequently may be required to sustain passing loads while acting as unsupported cantilevers. Data on the influence of position of wheel loads on deflections indicate that stresses in corners may be greatly reduced if an effective method of doweeling is provided.

Data on the fatigue of concrete indicate that plain concrete beams or slabs will sustain, without failure from bending, an indefinite number of repetitions of a load if the tensile fiber stress induced is less than 50 per cent of the modulus of rupture. For loads causing fiber stresses in excess of 50 per cent of the modulus of rupture, the tendency to failure increases rapidly with the increase of this excess of stress.

The subgrade soil investigations established that the bearing value of a clay soil varies with its moisture content. It is considered questionable whether attempts to control moisture by means of tile drains are of any merit in clay soils. It was found that brown-silt loam and yellow-clay soils resist further moisture saturation to a marked degree when they have a moisture content which is normal for the summer months. Other experiments indicated



that if the moisture content of any of these clay soils is reduced to a point where the soil crumbles readily, absorption takes place rapidly to the point of saturation.

Other results are taken to indicate that for perhaps a period of a year or more after a pavement is laid the bearing power of a clay subgrade soil may be affected materially by its moisture content at the time of construction. It is also considered probable that none of the clay soils exhibits sufficiently uniform elastic properties to justify an assumption of elastic subgrade supporting power for use in a design formula.

Data on the effect of truck traffic tests on different sections of the experimental road and notes on rigid pavement design are included.

**The use of explosives in agriculture**, E. R. GROSS (*New Jersey Stat. Circ.* 159, pp. 8, figs. 13).—Brief general suggestions are given regarding the use of dynamite as an explosive in stump and boulder blasting and ditching.

**Nitrogen formation in sewage digestion tanks**, BACH and SIERP (*Centbl. Bakt. [etc.]*, 2. Abt., 58 (1923), No. 19-24, pp. 401-411, fig. 1; 59 (1923), No. 1-4, pp. 1-7).—Studies with digested sludge from an Emscher tank to determine the origin of the nitrogen in the gases from such tanks, and especially to test the theory of Groenewege that such nitrogen results from the denitrification of nitrites in sludge, are reported.

The results showed that during the anaerobic decomposition of nitrogenous organic matter elementary nitrogen is set free, but that owing to the lack of oxygen nitrites are not formed. Where digested sludge in different dilutions and in layers of different depth was allowed to come into contact with air, there was a progressive formation of nitrites. A layer of scum on the surface hindered such nitrification by excluding the air. While it is considered possible that the nitrogen in the tank gases may be the result in part of the denitrification of nitrites formed before anaerobic conditions were produced by scum formation, everything indicates that the main part of such nitrogen is derived from the breaking down of nitrogenous organic matter under anaerobic conditions. Nitrite formation in sewage was found to be impossible without the unhindered entrance of air and the complete decomposition of the organic matter present.

Some of the chemical and bacteriological technique involved in these studies is briefly discussed.

**Hygienic aspects of use of sewage sludge as fertilizer**, A. WOLMAN (*Engin. News-Rec.*, 92 (1924), No. 5, pp. 198-202).—In a contribution from the Maryland State Department of Health, foreign and American regulations relating to the use of sewage sludge as fertilizer are summarized and recent experimental data presented.

It is shown that existing practice in this and other countries indicates that sewage sludge should not be applied to crops that are to be eaten raw. However, recent laboratory data have shown that if sewage sludge is held in a sludge digestion tank for a period of not less than 10 days, its application to the soil as a fertilizer may be carried out without detriment to the public health through the possible dissemination of vegetable-borne disease.

Regulations governing the disposal of wet sludge to farmers for fertilizing purposes are recommended, the features of which are that only such sludge shall be delivered to farmers as has undergone digestion for at least 10 days, and that sludge shall be used on ground only before crops are planted and shall not be sprinkled over or brought into direct contact with growing vegetables.



## RURAL ECONOMICS AND SOCIOLOGY.

**Economic history of American agriculture**, E. L. BOGART (*New York and London: Longmans, Green, and Co., 1923, pp. X+173, pls. 2, figs. 41*).—Those chapters from an economic history of the United States previously noted (E. S. R., 32, p. 891) which relate particularly to agriculture are republished in this volume.

**Drainage district farms in central Wisconsin**, E. R. JONES and B. G. PACKER (*Wisconsin Sta. Bul. 358 (1923), pp. 48, figs. 29*).—Interviews were held with 87 representative farmers on drained marsh land in central Wisconsin, and the individual stories of success or failure are briefly set down here as told by the farmers themselves.

**The proper position of the landowner in relation to the agricultural industry**, LORD BLEDISLOE (*Brit. Assoc. Adv. Sci. Rpt., 90 (1922), pp. 219-252*).—The address of the president to Section M (Agriculture) of the British Association for the Advancement of Science in 1922 is devoted to the subject of the landowner's responsibility to his tenants and to the improvement of British agriculture in the way of fostering the adoption of scientific methods. The efforts of the landlords in countries on the Continent in this respect are noted. The author urges British landowners to again take the position of leaders of the agricultural industry, and this is said to depend largely upon their ability to organize among themselves.

**Agricultural landowners**, LORD ERNLE (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), Nos. 6, pp. 489-496; 7, pp. 585-593*).—This is the substance of a lecture delivered at Oxford in August, 1923, in which the contribution of landowners to agricultural progress in Great Britain is historically reviewed and landowners are defended against the specific charges which have been brought against them of hostility to small holdings, wasting land, providing an inadequate supply of cottages, and of holding land contrary to the laws of nature and to natural rights.

**The Agricultural Holdings (Scotland) Act, 1923, with introduction, commentary, and appendixes**, J. S. C. REID (*Edinburgh: William Blackwood & Sons, 1923, pp. XIII+220*).—Comment is made upon the particular provisions of each section of this act, and decisions of the court covering similar provisions in earlier acts are cited. Specific questions with relation to matters requiring arbitration, the application of manures, and removings are discussed in appendixes, and numerous forms for the notices required by the act, statements of claims, arbitration, and awards are reproduced.

**The use of land in Denmark in 1919**, A. JENSEN (*Danmarks Statis. Meddel., 4. ser., 61 (1921), No. 2, pp. 205*).—Statistical information appears in part 2 of an annual publication, parts of an earlier issue of which were noted (E. S. R., 46, p. 93).

[**Land development and settlement in Palestine**] (*In Awakening Palestine*, edited by L. SIMON and L. STEIN. *London: John Murray, 1923, pp. 209-231*).—Two papers are published in these pages.

*Problems of land development*, J. Thon (pp. 209-218).—Legal landownership in Palestine is described. Statistical data showing the total area and the land owned by the Palestine Government and by Jews are briefly reviewed, and the conditions limiting agricultural development at the present time are noted.

*Land settlement in Palestine*, S. E. Soskin (pp. 219-231).—A scheme for close settlement and intensive cultivation in Palestine is set forth. Working plans for State aid in land settlement, principally in Denmark and the State of Victoria in Australia, are set forth, and the need of a land settlement board for Palestine is urged.



**Colonization in Algeria, 1830-1921** (*Algiers: Gouv. Gén. Algérie, Dir. Agr., Com. et Colon., 1922, pp. 87, pl. 1, fig. 1*).—A résumé is given by decades of the history of the colonization of Algeria, particularly between 1841 and 1900, and legislation dealing with land grants, sales and inheritance, credit facilities, and other questions is reviewed.

**Report to the Governor General of Algeria upon the awarding of prizes for agricultural enterprises**, P. BERTHAULT (*Algiers: Gouv. Gén. Algérie, Div. Agr., Com. et Colon., 1922, pp. [1]+58, pls. 3, fig. 1*).—These pages present a description of the southern section of Algeria, landholding systems in vogue there, and natural and economic factors of agricultural production. Brief descriptions are then given of farms which were awarded first and second prizes, gold medals, and other forms of recognition by a special commission appointed by the minister of agriculture.

**The Rural Credits Act and other amendments of banking law relating to agriculture** (*New York: Fed. Trade Inform. Serv., 1923, pp. 48*).—The texts of the Agricultural Credits Act of 1923 and of amendments of the Federal Farm Loan Act are given, together with digests of amendments to the National Banking Act and to the Federal Reserve Act liberalizing farm credits.

**The Agricultural Credits Act, 1923** (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), No. 7, pp. 649-654*).—The scheme of establishing credit societies in England and Wales, empowered to make loans to certain farmers, small holders, or allotment holders repayable within periods not exceeding five years, for the purpose of meeting such expenses as the purchase of seeds, fertilizers, feeding stuffs, the purchase of breeding and other livestock, machinery and implements, and fruit trees, and the erection of silos, barns, and fences, is outlined here. The manner of organizing and administering the functions of these societies is described briefly.

**[Wages in agricultural production]** (*In Wages in the United States and Foreign Countries. Washington: Govt., 1921, pp. 34-37*).—These pages comprise part of Schedule G of a statement of wages prepared for the use of the Committee on Ways and Means of the U. S. House of Representatives. The report consists of tabulations of wages in farming and fruit growing and the beet sugar industry in the United States and certain foreign countries, mainly between 1913 and 1920.

**Annual report [of the] Rice Growers' Association of California**, R. P. MERRITT (*Rice Growers' Assoc. Calif. Ann. Rpt., 1922, pp. 14, figs. 3*).—The first annual report of the president of an organization established in October, 1921, is presented which sets forth some of the marketing problems of rice growers in California.

**Farmers' Market Bulletin** (*North Carolina Sta. Farmers' Market Bul., 10 (1924), No. 67, pp. 11*).—Extracts from reports by the U. S. Department of Agriculture relating to Chadbourn, N. C., strawberry shipments and the marketing of North Carolina white potatoes in 1923 are furnished in this number. The usual partial list of products which farmers have for sale is also given.

**Agricultural resources and development** (*In Canada: Natural Resources and Commerce. Ottawa: Canada Dept. Int., Nat. Resources Intel. Serv., 1923, pp. 37-72, figs. 7*).—This is a chapter from a volume prepared by the natural resources intelligence branch of the Department of the Interior for Canada, and sets forth the arable land and extent of cultivated areas, crop production, livestock and dairy farming, fruit farming, and other agricultural industries.

**A brief survey of Irish agriculture**, E. A. M. MORRIS (*Ireland Dept. Agr. and Tech. Instr. Jour., 23 (1923), No. 3, pp. 236-251*).—A sketch is presented setting forth the yields of the principal crops in Ireland for certain years or periods of years since 1847, the size of holdings, and the production and export trade in livestock and livestock products.



**Danish agriculture and the world depression**, BLEDISLOE and C. TURNER (*Nineteenth Century*, 94 (1923), No. 562, pp. 811-819).—This account of Danish agricultural success emphasizes the importance of the education and training provided by the folk high schools and agricultural colleges, as well as the rôle played by cooperation among Danish small farmers. Crop yields are shown to have increased, and the Danish farmer is said to be making a greater profit than is the British.

**The possibilities of Franco-Polish commerce in agricultural products**, H. and J. HITIER (*Expansion Econ.*, 7 (1923), No. 11, pp. 5-14).—These pages give an account of a visit of a special French agricultural mission to Poland and some of the results of its study of the extent of surplus production and the requirements of Polish agriculture which may be met by commerce with France.

**Russian farming under the Soviet**, C. K. MICHENER (*Northwest. Miller*, 137 (1924), No. 1, pp. 33, 34, 51-53, figs. 6).—It is attempted to show that the agricultural policy of the Soviet Government of Russia has resulted in a very considerable recovery of agriculture and livestock industries, and that the Russian farmer is in a fair way to resume his former place in the production of the world's foodstuffs.

**The town and country church in the United States**, H. N. MORSE and E. DES. BRUNNER (*New York: George H. Doran Co.*, 1923, pp. XIII+17-179, fig. 1).—This volume, in the Town and Country Series (E. S. R., 48, p. 493), summarizes studies which have been noted from time to time, giving first a summary description of the regional divisions in which the town and country surveys have been carried on. Census and other data bearing upon the religious situation in the town and country area of the United States are presented preliminary to a chapter dealing more specifically with the data from 179 countries in 44 States. These indicate the distribution of churches and ministers, church membership, the evangelization of the community, and the church parish.

It is indicated that in the regions surveyed there is an average of one church for every 463 inhabitants. By regions, the South has proportionately the most churches and the range the fewest. One-fifth of the communities, containing one-thirteenth of the population, have no churches. There is one minister for every 1.7 churches and for every 767 people. Fifty-five per cent of the ministers serve each two churches or more, only one community in five having a full-time, resident minister. It is considered that the town and village population is more thoroughly evangelized than the country population, taken as a whole. The church is said not to reach the farm tenants as well as it does the farm owners. The average church parish includes 20 square miles.

Subsequent chapters are devoted to the interrelations of town, village, hamlet, and open country; church growth and decline; home mission aid as a factor in rural church development; religious education in the rural church school; equipment and finance; the rural church and racial groups; tenant and migrant; and the rural church program.

It is indicated that church membership tends to follow population. The chances of growth of a country church vary according to its distance from town, the farther away the better. In 25 counties within 10 years 142 churches have been abandoned, while 91 new ones have been organized.

Every fifth church in these 25 counties receives home mission aid. Only 34 out of 211 aided churches are entirely free from competition, and the use of home mission money to further competition is held to be difficult to justify and the hardest to deal with in the larger villages and the towns. It is suggested that 149 of the 211 aided churches could be dispensed with without essential loss.



The real problem of the average country Sunday school is held to be largely untouched by present programs. With regard to finances, it is said that the annual budget, every-member canvass, and envelope systems are being increasingly developed. One-third of the town and country churches, however, use all three elements in an efficient financial system, thereby exceeding in their per capita contributions those churches without any official financial system by from 12 to 100 per cent, depending on the region. Of all moneys raised 30 per cent is given to benevolences and 41 per cent to salaries. The average country church is said not to have adapted its program to the changed conditions of rural life, nor to that greatest untouched field of Christian effort in rural America, the work for boys and girls.

**Report on the working of the cooperative societies in the Punjab for the year ending July 31, 1922**, H. CALVERT, W. W. POWELL, ET AL. (*Punjab Coop. Soc. Rpt.*, 1922, pp. [42]+XCVII).—This report brings up to date the series previously noted (E. S. R., 48, p. 691).

**Cooperation in Mysore**, M. H. HUSEIN (*Madras Bul. Coop.*, 15 (1923), No. 5-6, pp. 218-228).—A review is given of the position of agricultural and non-agricultural credit societies, noncredit societies, cooperative stores, agricultural and land mortgage banks, and minor societies in this Indian State.

**[Abstract of agricultural statistics for the United States]** (*U. S. Bur. of the Census, Abs. 14. Census U. S.*, 1920, pp. 575-887).—A summary of the more important and significant statistics from the 1920 census (E. S. R., 50, p. 296) is presented. A section on general information includes tables concerned with farm property; the number and characteristics of farmers; farm mortgages; expenditures for labor, fertilizers, and feed; cooperative marketing; and farm facilities. Other sections are devoted to livestock on farms and not on farms, and crops and miscellaneous products.

**Comparative Philippine yields of sugar per hectare for the 1922-23 season**, H. A. LEE (*Sugar Cent. and Planters News*, 4 (1923), No. 12, pp. 643-648).—A brief discussion is presented in English and Spanish of the yields per hectare from a number of centrals throughout the Philippines, where accurate cadastral surveys have been completed. The accompanying tables show the areas in plant cane, the areas in ratoon cane, and the total.

**Statistics of agriculture in 1921 [for Iceland]**, P. ÞORSTEINSSON (*Hagskýrslur Íslands. Búnaðarskýrslur*, 1921, pp. 14+31).—The livestock on hand, land under cultivation, crops harvested, and farm improvements are discussed briefly. Seven principal tables incorporate statistical data for 1921.

**[Agricultural statistics for Norway]** (*Statist. Årbok Kongeriket Norge*, 40 (1920), pp. 32-48; 41 (1921), pp. 46-66; 42 (1922), pp. 40-59).—Sections of these statistical reports continue the series previously noted (E. S. R., 43, p. 795), adding information for later years.

**Agricultural statistics for the year 1921 [for Bulgaria]**, K. G. POPOFF (*[Bulgaria] Dir. Gén. Statis., Statis. Agr.*, 1921, pp. [4]+131).—This publication contains statistical information with reference to the areas sown, yields, and the agricultural inventory for Bulgaria, 1921, with comparisons.

**Statistics of the production of cereals and legumes in 1923** (*Estadística de la Producción de Cereales y Leguminosas. Madrid: Junta Consult. Agron.*, 1923, pp. [37]).—This annual statistical report continues the series previously noted (E. S. R., 49, p. 193).

## AGRICULTURAL EDUCATION.

**Agricultural teacher training**, T. H. EATON (*Fed. Bd. Vocat. Ed. Bul.* 90 (1923), pp. V+43).—This bulletin is the result of study of the criteria for the development of departments of teacher training by the agricultural education



service of the Federal Board for Vocational Education and of the special study by the author of the principles of organization for training teachers of agriculture. The functions of selection and preparation are presented in considerable detail, and a tentative scheme of a preparatory curriculum for high school teachers of agriculture is presented. The placement function is briefly noted.

**Development in vocational education in home economics, 1923**, A. S. BAYLOR (*Vocat. Ed. Mag.*, 2 (1924), No. 5, pp. 391-398).—The objectives and programs of State supervision are said to have been much more clearly defined and outlined during the year, and more and improved State supervision has been provided. The work of the year in all-day schools, part-time and evening schools and classes, teacher training, and negro education is noted, and recommendations are made for future work.

**Objectives in home economics for the seventh, eighth, and ninth grades**, F. ZUILL (*Jour. Home Econ.*, 16 (1924), No. 3, pp. 107-112).—These are outlined as health education, including the nutritional phase and the relationship of clothing to health, education for good citizenship and the wise use of leisure, and the provision of prevocational opportunities.

**The campaign against malnutrition** (*U. S. Pub. Health Serv., Pub. Health Bul.* 134 (1923), pp. VI+37).—Some suggestions are offered concerning the conduct of nutrition work in country districts, largely by means of a program of general health education in the schools. This bulletin was prepared by the advisory committee on foods and nutrition of the National Child Health Council in cooperation with the U. S. Public Health Service.

**A questionnaire on methods of teaching textiles and clothing in secondary schools**, A. H. HESS (*Jour. Home Econ.*, 16 (1924), No. 3, pp. 115-119).—The returns received by the committee on educational essentials in textiles and clothing of the American Home Economics Association in connection with a study of textile instruction of high school grade are reviewed.

**Third International Congress of Home Economics Education, 1922** (*III<sup>e</sup> Congrès International d'Enseignement Ménager*, 1922. Paris: Off. Familial-Ménager, pp. XXXV+536 pls. 2).—Lists of delegates, participating bodies, and committees are furnished, and reports are submitted by the delegates covering the status of home economics education in the countries represented at this congress. Section 1 includes reports of home economics instruction in primary and secondary schools, continuation schools, and teacher-training institutions, as well as inspection or supervision. Section 2 is devoted to rural and agricultural phases of home economics, and section 3 to professional training and scientific and sociological aspects, as well as education of domestics and minor topics.

**Course of study in nature study and agriculture prescribed for the elementary schools of North Dakota, 1923**, C. C. SCHMIDT ET AL. ([*Bismarck, N. Dak.*]: *State Supt. Pub. Instr.*, 1923, pp. 32).—Suggestions are furnished for oral instruction in nature study for the lower grades, reading matter for the upper grades, and projects. The section devoted to agriculture presents suggestions for teachers, outlines for courses of study, and suggested recitation topics with field and laboratory applications for the seventh and eighth grades.

**A manual and outline for the teaching of agriculture in the elementary schools of Oregon, 1923**, J. A. CHURCHILL (*Salem, Oreg.*: *Supt. Pub. Instr.*, 1923, pp. 7).—This outline is based upon the text by Davis previously noted (*E. S. R.*, 48, p. 297), aiming to adjust its contents to the variable conditions found in the local community.

**Syllabus for agriculture prescribed for the high schools of the State of North Dakota**, rev. by E. H. JONES (*Bismarck, N. Dak.*: *Dept. Pub. Instr.*, 1923,



pp. 31).—A topical outline, list of laboratory exercises, suggestions for the equipment of libraries and laboratories, and suggestions for teachers are given.

**Climates of the world, with introductory exercises on the climatic elements**, G. T. TREWARTHA (*Madison: Wis. Geogr. Press, 1923, pp. 8, figs. 23*).—Questions and exercises and material for laboratory use in colleges and in graduate courses are presented. The general plan includes five sections, namely, the climatic elements, the weather map, the climatic zones, genetic classification of climates, and climates of the earth.

**Farm mechanics for Utah high schools** (*Salt Lake City: Utah State Bd. Vocat. Ed., Div. Agr. Ed., [1923], pp. 131, figs. 34*).—This bulletin presents the Utah State program in farm mechanics and courses of study. It describes in detail job analysis, lesson outlines, special teaching devices, farm mechanics, buildings and equipment, and records.

**Economics of the family**, C. W. TABER and R. A. WARDALL (*Philadelphia and London: J. B. Lippincott Co., 1923, pp. XII+224, figs. 11*).—A textbook for high school students is offered here, in which the economic principles underlying individual and household matters are stated. Problems are introduced preceding the discussions of specific topics, and in the appendix are suggestive lists of investigations, projects, questions, and discussion for individual, group, or class assignments.

**Economics of the household: Its administration and finance**, B. R. ANDREWS (*New York: Macmillan Co., 1923, pp. IX+623*).—This is a consideration of the economic bases of household matters, presented as a textbook for colleges and other higher institutions and as a reference book in schools. Such topics as the household income, expenditure, and capital and savings; investments and life insurance; social aspects of housing, food, and clothing; household operation, including labor and equipment; and expenditures for personal items and self-improvement are treated in detail. The final chapter gives some practical plans for handling financial and other economic resources of the household. The appendix presents a series of about 500 problems dealing with household economics.

**A suggestive budget for families of small income** (*Cleveland: Associated Charities, Home Econ. Com., 1923, pp. 51, fig. 1*).—This bulletin was prepared by the home economics committee of the Associated Charities in Cleveland, Ohio. Tables and estimates are given, suggesting minimum food and clothing requirements and expenditures for advancement and operating.

**A cooperative course in nutrition**, F. A. OTIS (*Jour. Home Econ., 16 (1924), No. 3, pp. 113, 114*).—Courses offered at the University of Cincinnati, and so conducted that students spend one half their time in school and the remaining half gaining practical experience as employees in industries and institutions such as lunch rooms, cafeterias, hospitals, and foods laboratories, are briefly noted.

**Home and community hygiene**, J. BROADHURST (*Philadelphia and London: J. B. Lippincott Co., 1923, 2. ed., rev. and enl., pp. XV+444, pls. 13, figs. 105*).—This is the second edition of a textbook previously noted (*E. S. R., 40, p. 694*). The chapter on sewage has been entirely rewritten, new illustrations have been inserted, and minor changes have been made in the text.

**Laundrying: Home—institution**, L. R. BALDERSTON (*Philadelphia and London: J. B. Lippincott Co., 1923, pp. XII+389, pls. 3, figs. 186*).—The discussion presented here covers such points as the effect on laundrying processes of fiber, fabric, and color, and the best way to conserve these and to secure the desired finish, including the matter of laundry supplies and equipment for the home and the institution. A chapter on teaching suggestions and outlines of courses is included.

## NOTES.

---

**Massachusetts College.**—A gift of \$25,000 has been made by the heirs of the late Frederick G. Crane of Dalton. The income is to be expended to aid undergraduates of limited financial resources interested in the promotion of Massachusetts agriculture, preference being given to Berkshire County.

**Minnesota University and Station.**—A project covering a study of electric current in farming has been initiated. A commercial power company is furnishing an electric line in the vicinity of Red Wing as their part of a cooperative agreement in this study. A farm business survey has been taken of the farms which are to be equipped with electric apparatus, and account books have been furnished which are to serve as the basis for studying the farm business during the next year. A power inventory has also been taken and an estimate made of the power requirements of these farms and of the amount and kind of electrical equipment that will be needed. After the equipment is installed the agricultural engineering division is to keep a careful check on the use of electric current and the discovery of new ways in which it can be profitably applied to farm operations.

The study is being undertaken cooperatively by the agricultural engineering and farm management divisions. The objective is to determine to what extent electrical current can profitably be used in farm operation and particularly to determine the place of the electric current in reducing the labor requirements.

The *Minnesota Farm Review*, issued weekly for several years, has been discontinued, and a monthly magazine known as *The Gopher Countryman* has been established by the students of the college of agriculture, forestry, and home economics. From its columns we learn of the appointment of A. L. Strand, assistant extension entomologist of the Pennsylvania College, as assistant entomologist vice Dr. J. R. Parker, who has returned to the Montana Station as associate entomologist. Miss Edna V. Anderson has resigned as assistant professor of home economics to accept a position as instructor in physiological chemistry and allied subjects in Yenching College, Peking, China. G. R. B. Elliott, assistant professor of agricultural engineering, resigned April 1 to engage in commercial work.

**Missouri University and Station.**—The agricultural engineering and rural life departments have started a cooperative project on the relation of electricity to agriculture. Studies will be made in communities where electricity from central power stations is being used. Attention will also be given to the cost and practicability of carrying out different farm operations with electricity.

The field crops and agricultural engineering departments are beginning a cooperative land clearing project. Investigations will be made with a machine called an "iron goat" or "sprout mower." Tests will be made at different seasons and on different sizes of brush. The cost of clearing with explosives will also be studied.

The departments of soils, animal husbandry, and rural life, the photographer, the agricultural editor, the dean and director, and the agricultural library are now installed in new quarters in the new agricultural building just completed.



The department of field crops, poultry husbandry, and agricultural education and the agricultural extension service have much more ample space in the old agricultural building than formerly. The department of field crops is reorganizing its seed testing laboratory, and when its installation is completed it is expected that the laboratory will rank among the best equipped in the country.

A recent survey of soy bean production in Missouri shows that about 250,000 acres were grown in 1923, exclusive of soy beans grown with corn. Of this acreage, 85 per cent was planted with four of the six varieties recommended by the station.

During the coming summer an exhaustive survey of pasture conditions in the Ozark region of the State is to be undertaken by C. A. Helm. B. M. King has been added to the field crops staff to study the problems of cotton production in southern Missouri.

**Wisconsin University and Station.**—Recent work by the departments of agricultural chemistry and poultry has shown that sunlight may be a factor in animal growth similar in importance to the rôle which it plays in the development of green plants. Experimental work with chickens has demonstrated that leg weakness, a disease which commonly causes severe losses among the early hatchings of the season, can be prevented if the animals are exposed to the direct light of the sun. It also appears that ordinary window glass decreases greatly the effectiveness of sunlight in comparison with unfiltered rays. Such vitamin-carrying food as green plants, cod liver oil, or eggs may be fed to chickens when they are grown under conditions of reduced sunlight (cloudy days, etc.) or within doors and excellent results obtained. The use of eggs in chick food, especially infertile eggs from the incubator, seems to be the simplest and most convenient way of handling the leg weakness problem.

A patent pending in the U. S. Patent Office for an improved type of brush breaking plow devised by John H. Swenhardt and F. W. Duffee of the agricultural engineering department has been assigned to the College of Agriculture. This plow introduces a new feature which greatly facilitates the breaking of brush land. The plow is being manufactured commercially, but with the university controlling the patent any plow manufacturer will be in position to use the principle upon arrangement with the institution.

In view of the extremely adverse weather conditions which prevailed, the attendance at the 1924 Farmers' Week was gratifying, reaching between 1,200 and 1,300 people of whom over 800 were women.

Tests recently conducted at the station have indicated that activated sludge material compares very favorably with other forms of fertilizers in common use. Excellent results have been obtained in using it as a source of nitrogen in mixtures with other fertilizing material on such crops as corn and potatoes, particularly on light soils. For lawns and golf courses it is deemed especially promising because it is odorless and the large available amounts of organic nitrogen bring the quick response in growth which is so desirable for this purpose.

A fellowship for the study of the crown gall disease has been established as a result of recent findings which indicate that this disease of plants may be held in check by cultural practices. Nurserymen have suffered heavily from the rejection of infected nursery stock because of the disease, and the American Nurserymen's Association has voted to raise from \$10,000 to \$12,000 to carry on this work, the fund to be administered by the Crop Protection Institute. It is expected that the research work will be done mainly at this university and the Iowa College.

The sum of \$5,000 has been subscribed by a large pickle concern for the continuance of cucumber mosaic work, which since 1919 has been in progress in



cooperation with the U. S. Department of Agriculture. The trial fields for this work are located at Rockland in LaCrosse County. Recent studies have shown that cucumber mosaic winters over on the wild ground cherry (*Physalis*), pokeweed, milkweed, and wild cucumber. The eradication of these host plants at Rockland and Madison has seemed to check the disease to a considerable extent.

The establishment of an experimental electrified farm community in the vicinity of Madison for the purpose of studying the practical value of electric service to farmers was decided upon at a meeting April 8 of a committee organized for the purpose of investigating the practical possibilities of the electrification of Wisconsin farms. The objective of this work is set forth as to apply experimentally electric service to as many agricultural uses as is possible and profitable and to study its effect on the farm income, to observe and record first hand data on the costs entering into the building of a rural line and its operation, and to develop the practical use of electricity on the farm to the point where it may be secured at rates making its use even more advantageous.

Dr. A. L. Whiting has been appointed associate professor in agricultural bacteriology.

**New Buildings for Two Agricultural Colleges in Great Britain.**—Noteworthy buildings for their agricultural departments are under construction by the University College of North Wales and the University of Leeds.

At the first-named institution the new buildings are to form the central feature of new science buildings designed as a part of a memorial to the officers and men of North Wales who fell in the World War. The cost is to be met from the North Wales Heroes Memorial Fund, supplemented by £15,000 from the Development Fund for the agricultural department.

The corner stone of the agricultural building was laid by the Prince of Wales November 1, 1923. It consists of a front and rear portion, the former of brick and stone and the latter of white cement. The front portion is of two stories to be used for administration, agricultural zoology and botany, and the investigation of animal diseases. The rear portion is allotted to agricultural chemistry and forestry. A special feature is its flat roof, which will be utilized for greenhouses and insect cages.

The agricultural department is at present working under great disadvantages, being housed partly in rooms in the main college building, partly in an attached building formerly occupied by the education department, and partly in an army hut fitted up as a temporary laboratory for agricultural chemistry.

The agricultural department of the University of Leeds is similarly handicapped. Funds for a new structure to cost £60,000 have been provided by several private gifts, about £10,000 from the Yorkshire Council of Agricultural Education, £15,000 from the Development Fund, and the balance, together with the site, from the university.

A lot 190 ft. long by 125 ft. wide has been obtained, and a two-story building is under way. Two lecture rooms 50 by 24 and 35 by 19 ft., a museum 50 by 27 ft., a library, offices, several classrooms, and accommodations for the biological department are provided for on the first floor. The second floor contains numerous classrooms, laboratories for nutrition research, lecture rooms, etc. The roof surface is to be utilized for greenhouses and similar work, and extensive storage and other space is provided in the basement.

The corner stone was laid April 4 by the Hon. Noel Buxton, Minister of Agriculture and Fisheries, the proceedings being presided over by the Duke of Devonshire.



# EXPERIMENT STATION RECORD.

VOL. 50.

ABSTRACT NUMBER.

No. 9.

---

## RECENT WORK IN AGRICULTURAL SCIENCE.

---

### AGRICULTURAL CHEMISTRY—AGROTECHNY.

**Treatise on general and industrial organic chemistry, II**, E. MOLINARI, trans. by T. H. POPE (*Philadelphia: P. Blakiston's Sons & Co., 1923, 3. ed., rev. and enl., pp. VIII+457-897, figs. 303*).—This volume completes the English translation of the **third** Italian edition (*E. S. R., 45, p. 310*).

**Colloid chemistry in the technology of oils and fats**, N. G. CHATTERJI (*Chem. Age [London], 10 (1924), No. 240, pp. 56-58*).—This is a general discussion of the application of the principles of colloid chemistry to industries concerned with the refining of oils and fats, industries in which glycerids undergo chemical changes but are not saponified, and industries based upon the saponification of oils and fats.

**Chemistry of vitamin A.—I, Separation of the effective constituent of cod liver oil and its properties**, K. TAKAHASHI and K. KAWAKAMI (*Jour. Chem. Soc. Japan (Nippon Kwagaku Kwai Shi), 44 (1923), pp. 590-605; abs. in Jour. Soc. Chem. Indus., 42 (1923), No. 38, p. 904A*).—The authors are of the opinion that they have isolated vitamin A in almost pure form from cod liver oil, butter, and egg yolk. The method as applied to cod liver oil is as follows:

One kg. of cod liver oil was saponified by heating at from 80 to 90° C. for 30 minutes with 2 liters of alcohol containing 20 per cent KOH. The saponified material was removed by adding gradually to the solution, after cooling (2 liters of a 28 per cent alcoholic solution of calcium chlorid, agitating the mixture for 1 hour, and filtering. The unsaponifiable matter was then saturated with carbon dioxid, the solvent distilled off under reduced pressure at a temperature below 60°, and the residue extracted with ether or petroleum ether. The extract was purified still further by treating with dilute hydrochloric acid and 50 per cent alcohol containing a small amount of alkali to remove the soap and fat, drying, and expelling the solvent in a current of carbon dioxid. The residue thus obtained was dissolved in about 50 cc. of from 80 to 90 per cent methyl alcohol and cooled at 0° for from 2 to 3 hours, during which time from 3 to 5 gm. of cholesterol separated. After removing the impurities by means of digitonin, the solution was concentrated to a viscous sirup, dissolved in a small amount of from 80 to 90 per cent methyl alcohol, and cooled at -20°. The semicrystalline substance which separated at this point is considered to be vitamin A, the yield being about 0.1 per cent of the original material.

The material is composed of "carbon, hydrogen, and oxygen, contains no nitrogen, and appears to be an aldehydic substance. It is very hygroscopic and reduces ammoniacal silver solution, Fehling's solution, and phosphotungstic acid. It is unstable in presence of light and oxygen, and is rendered inactive by reducing with hydrogen in the presence of platinum black; it is stable when

dissolved in ether, alcohol, and especially in fat. It is insoluble in water, but soluble in benzene, acetone, and other organic solvents. Its chloroform or carbon tetrachlorid solution gives the lipochrome reaction and a blue coloration with Japanese acid clay. The health of a mouse at the point of death owing to lack of vitamin A was restored by giving 0.08 mg. of the constituent per day during 10 days."

**The action of ammonium hydroxid and other alkaline compounds upon insulin,** E. J. WITZEMANN and L. LIVSHIS (*Jour. Biol. Chem.*, 58 (1923), No. 2, pp. 463-474).—Insulin has been shown to be more or less completely inactivated at room temperature by 0.5 or 0.7 N ammonium hydroxid. The process requires several days for completion, but on acidifying the ammoniacal solution with hydrochloric acid the original activity is usually restored quite rapidly. Sodium and potassium hydroxid in solutions as dilute as 0.1 N also inactivate insulin, but the reaction is irreversible. Sodium carbonate and bicarbonate and disodium phosphate have but little effect upon insulin.

"The known facts concerning the reversible inactivation of insulin by ammonium hydroxid suggest a tautomeric rearrangement. Nothing definite can yet be said as to the nature of the groups that would be involved in this rearrangement."

**H-ion concentration v. titratable acidity in culture mediums,** A. J. QUIRK and E. H. FAWCETT (*Jour. Infect. Diseases*, 33 (1923), No. 1, pp. 1-59, pl. 1, figs. 10).—An extensive investigation is reported from the Bureau of Plant Industry, U. S. D. A., of the relationship between the titratable acidity of peptone beef infusion broth as expressed in Fuller's scale and the corresponding pH values.

As a starting point in the comparison, the pH values were determined electrometrically of the phenolphthalein end points ordinarily used in the titration. The first change was found to take place at pH 7.8, a faint but decided pink color to develop at pH 8.2, and a rose pink at pH 8.4. A chart is given of these colors. In commenting on this chart, the necessity is emphasized of a consistent choice of color in determining the end point in phenolphthalein titrations.

The study, which should be consulted in the original for details, has led to the conclusion that if a uniform method is used in the preparation of peptone beef infusion broth titratable acidity may be interpreted in terms of pH. If the infusion is prepared in the cold by adding water equal to 2 times the weight of the beef or in the hot by adding water equal to  $2\frac{1}{2}$  times the weight of the beef, making up the volume in each case after filtering, the Fuller's scale values may be translated into pH values by the use of the formula  $8.2 - F/10 = \text{pH}$ , in which F equals the given Fuller value. In titrating mediums, a standardized technique is considered as essential as in making colorimetric or electrometric H-ion concentration determinations.

Directions are given for the adjustment of medium over a range broad enough to cover almost any need of the plant or animal pathologist and for adjusting to any given Fuller's scale value any finished autoclaved beef infusion broth. The same relation of scales is thought to hold good for all standard mediums based on a 1 per cent peptone beef infusion, with the exception of gelatin in the extreme ranges, especially on the acid side. The principles covering the correction of beef infusion mediums do not apply to beef extract mediums, in the adjustment of which knowledge of the pH value is considered to be useful.

**The titration of amino and carboxyl groups in amino acids, polypeptids, etc.—I-III, Investigations with aqueous solutions,** L. J. HARRIS (*Roy. Soc. [London] Proc., Ser. B*, 95 (1923), No. B 670, pp. 440-484, figs. 14).—This paper consists of three parts as follows:

I. *The theory of titration applied to amino acids and polypeptids.*—In this the theory of titration is discussed in relation to amphoteric electrolytes in



general and amino acids resulting from protein hydrolysis in particular. Considering a solution containing amino acids as a mixture of bases and acids with the same dissociation constants as those of the amino (basic) and carboxyl (acid) radicals, the theory is shown to hold with considerable accuracy. In the neutral monaminomonocarboxylic acids, the amino group is shown to be completely dissociated at pH values ranging from 0.1 to 0.71 and the carboxyl group at pH values from 10.6 to 11.73. In the case of the dicarboxylicmonamino acids, one carboxyl group of glutamic and aspartic acids is completely dissociated at all pH values less acid than 6.4 and 5.8, respectively, the remaining acid groups being dissociated at more alkaline, and the basic groups at more acid reaction, respectively. One basic group of the diaminomonomocarboxylic acids, arginin and lysin, is almost completely dissociated at a pH value somewhat more alkaline than 7.

In mixtures of the three classes of amino acids and polypeptids, the titration end points are as follows: By titrating to pH 7 one-half of the carboxyl groups of glutamic and aspartic acids, one-half of the amino groups of lysin and arginin, together with any mineral acid or strong base present in the mixture will be estimated. By titration to the alkaline end point  $\text{pH}=13$  the total carboxyl and phenolic (tyrosin) groups are estimated, and by titration to highly acid end points the total amino groups and the imino group in histidin (but not in tryptophan) may be determined.

II. *Experimental verification—pH measurements, amino acid estimations.*—Experimental verification of the theories discussed in part 1 is reported in titrations of  $\text{NH}_2$  and  $\text{COOH}$  in various amino acids. In this the use of the quinhydrone electrode is suggested as a convenient and accurate method of titration.

III. *Estimation of  $\text{NH}_2$  and  $\text{COOH}$  by use of indicators.*—This discusses the application of the colorimetric method to the various titrations. It is stated that histidin may be estimated with an accuracy almost equal to that of the titration of a strong alkali with the standard acid by titrating with standard  $\text{HCl}$  to pH 3.8 with bromophenol blue as indicator.

**The detection of pentose, formaldehyde, and methyl alcohol, J. B. SUMNER** (*Jour. Amer. Chem. Soc.*, 45 (1923), No. 10, pp. 2378–2380).—The author states that a stable solution of Bial's reagent for pentoses may be made by dissolving 6 gm. of orcinol and 40 drops of 10 per cent ferric chlorid solution in 200 cc. of alcohol. In using this reagent 15 drops are mixed with 5 cc. of the sugar solution to be tested and an equal volume of fuming hydrochloric acid and the mixture heated in boiling water. If 1 mg. of arabinose or xylose is present, a clear blue color develops. With less than this amount the color is greenish, and with larger amounts a precipitate forms rapidly.

The orcinol reagent may also be used in testing for formaldehyde. On adding 10 drops of the orcinol solution and 2 cc. of concentrated hydrochloric acid to 2 mg. of formaldehyde in 2 cc. of water a white precipitate forms immediately. If only 0.2 mg. of formaldehyde is present the precipitate does not appear for several minutes, but is hastened by heating the solution. With still smaller amounts of formaldehyde no precipitate is formed, but the solution turns yellow on heating. With amounts of formaldehyde smaller than 0.1 mg., the addition of an excess of sodium hydroxid after heating produces a pink or salmon color with a green fluorescence, which is said to be so intense that the test shows 1 part of formaldehyde in 10 million parts of water. Acetaldehyde treated in the same manner gives a solution with no fluorescence.

In applying the precipitation test to the detection of methyl alcohol, the alcohol is oxidized by potassium dichromate and sulphuric acid. It is not necessary to remove these reagents, but it is considered advisable to drive off

some of the acetaldehyde by heating in a large test tube in boiling water. In making the test an aqueous 0.5 per cent solution of orcinol is used, and the addition of ferric chlorid is omitted. The technique of the test as applied to alcoholic beverages is given in detail. Formic acid, amyl alcohol, acetone, and furfural are said not to interfere with the test.

**The detection of methanol in the presence of ethanol,** C. H. LAWALL (*Wagner Free Inst. Sci. Phila. Trans.*, 10 (1923), pp. 55-62).—Various tests for the detection of methyl alcohol in ethyl alcohol are discussed briefly, particularly the test given in the ninth edition of the U. S. Pharmacopoeia, the modification of this test proposed by Ehman (*E. S. R.*, 41, p. 715), and the method proposed for adoption in the tenth edition of the U. S. Pharmacopoeia, which is based upon this modification. As a result of numerous tests, the author proposes a still further improvement which does away with the necessity of reducing the temperature of the liquid during the test. The technique of the proposed test is as follows:

"Dilute the alcohol with water to contain about 5 per cent by volume of ethyl alcohol. To 5 cc. of this diluted alcohol, contained in a graduated test tube of 20 cc. capacity, add 5 or 6 drops of phosphoric acid and 2 cc. of a 3 per cent aqueous solution of potassium permanganate and allow the mixture to stand for 10 minutes. Add 1 cc. of an aqueous 10 per cent solution of oxalic acid and allow it to stand until the liquid is a transparent brown. Now add 5 cc. of a previously diluted and cooled sulphuric acid (which has been diluted in the proportion of 3 volumes of water to 1 volume of acid), add 5 cc. of fuchsin sulphurous acid T. S., mix well, and allow to stand for 10 minutes. At the end of this time the solution, when observed against a white background, should not show a distinct blue or violet tint (methyl alcohol)."

**Notes on the ether extract of feces,** A. D. HOLMES and R. H. KERR (*Jour. Biol. Chem.*, 58 (1923), No. 2, pp. 377-381).—In connection with the studies on the digestibility of fats conducted at the office of Home Economics, U. S. D. A., an examination was made of the ether extract of the feces or the so-called fecal fat to see how it compared with the special fats of the diet. A comparison was first made of the coefficients of digestibility of the various fats used, as determined by the usual ether extraction method, with the values obtained by the method of Folin and Wentworth (*E. S. R.*, 25, p. 809), which makes allowance for the fatty soaps. In this comparison the coefficients obtained by the ether extraction method were slightly but consistently lower than by the other method, which is contrary to what would be expected if there were appreciable amounts of soap in the feces.

For the fecal fat, examinations were made of the feces from metabolism experiments in which the fats used were goose fat, oleo oil, and corn oil, the coefficients of digestibility of which were 95.2, 98.8, and 96.9, respectively. Iodin and saponification numbers were determined on both the food fat and the ether extract of the feces with the following results:

For goose fat the iodine and saponification numbers of the natural fat were 68.53 and 194.76 and of the fecal fat 28.57 and 159.11, respectively. For oleo oil the corresponding figures were 44.31 and 207.27 for the natural fat and 27.93 and 146.17 for the fecal fat. For the corn oil the iodine number of the natural fat was 123.1, and the iodine and saponification numbers of the fecal fat 34.26 and 108.6.

**Standard methods for the examination of water and sewage** (New York: Amer. Pub. Health Assoc., 1923, 5 ed., rev., pp. IX+111+III, fig. 1).—This is a revision of the volume previously noted (*E. S. R.*, 44, p. 805).

**Carbon dioxide content of beverages,** J. CANNIZZARO (*Indus. and Engin. Chem.*, 15 (1923), No. 10, pp. 1074, 1075).—A rapid volumetric method of de-



termining carbon dioxide in lightly carbonated beverages is described. The method consists in pipetting quickly a definite volume of the well-cooled beverage, transferring it to a measured volume of standard sodium carbonate, and titrating with standard acid to the disappearance of the pink color. The solution must be kept cold during the titration. The values obtained are corrected for fixed acid, which is determined on a separate portion of the sample by boiling to expel carbon dioxide, cooling, and titrating with sodium carbonate, using phenolphthalein as indicator.

**Formation of formic acid by caramelization of cane sugar**, S. G. SIMPSON (*Indus. and Engin. Chem.*, 15 (1923), No. 10, pp. 1054, 1055, figs. 2).—Samples of cane sugar of identical weights were heated in loosely stoppered tubes in the oil bath at different temperatures for varying periods of time and were then analyzed for formic acid. The amount of formic acid was found to be proportional to the caramelization of the sugar, which in turn was proportional to the time and temperature of heating.

It is concluded that food products which have not been heated above 160° C. produce no appreciable amounts of formic acid by caramelization of the sugar. If the conditions of temperature and time of heating in the preparation of a food product of definite sugar content are known, the amount of formic acid which may be present as a result of caramelization can be estimated approximately and due allowance made in the determination of formic acid.

**Contribution to the study of miscibility.—Application to the detection of adulteration of cacao butter and the identification of certain pure products**, H. ROSSET, MARANGE, and VINTER (*Ann. Falsif.*, 16 (1923), No. 180, pp. 454-468, figs. 5).—This paper consists of a general discussion, with many literature references, of the principle of the critical temperature of solution or miscibility, a description of the apparatus for determining this constant, and the application of the method to the detection of the adulteration of cacao butter, using anilin as solvent, and to the identification of impurities in commercial products such as nitrobenzene in anilin and benzene in monochlorobenzene.

**The estimation of boric acid in "liquid eggs" and other foodstuffs**, G. W. MONIER-WILLIAMS (*Analyst*, 48 (1923), No. 570, pp. 413-415).—The method described, which is essentially that of De Koningh (*E. S. R.*, 8, p. 861), depends upon the removal of most of the lime from the solution as calcium sulphate before neutralization and the subsequent precipitation of the phosphoric acid by magnesia mixture. The technique is described, and data are reported on analyses of egg yolk and dried milk powder to which various amounts of boric acid had been added.

**The analysis of coagulated milk**, BANCE (*Ann. Falsif.*, 16 (1923), No. 180, pp. 468-483).—A detailed description is given of a method of analyzing coagulated milk which is based upon the method of Gascard (*E. S. R.*, 31, p. 810), combined with determinations of the simplified molecular constant and of lactose by total hydrolysis according to the method of Hildt (*E. S. R.*, 43, p. 14).

**Some determinations on the soluble nitrogen compounds of cream and butter**, I. W. FERRIS (*Jour. Dairy Sci.*, 6 (1923), No. 4, pp. 320-329).—Data are reported from the Bureau of Chemistry, U. S. D. A., on the soluble nitrogen compounds in samples of cream and in fresh and storage butter made from sweet cream and from neutralized sour cream.

Cream and butter with the lowest scores gave the highest results for nitrogen present as amino acid and ammonia and as nitrogen not precipitated by phosphotungstic acid. Lower results were obtained with butter than with the corresponding cream. Butters which had been kept in cold storage for a month gave higher results than fresh butter, and still higher results were obtained



with samples kept in the ice box at 15° C. for a month. Samples of butter made from cream which had been allowed to sour before being pasteurized showed the highest content of soluble nitrogen when the butter was fresh and also the greatest increase during storage.

**A comparison of the Babcock and the Roesse-Gottlieb (Mojonnier) methods for determination of butterfat in milk,** C. A. PHILLIPS (*Jour. Dairy Sci.*, 6 (1923), No. 6, pp. 549-555).—Determinations are reported of the fat content of 50 samples of milk by the Mojonnier test, the Babcock test, and the Babcock test with the use of glymol. In the Babcock test the readings were made from the bottom of the lower meniscus to the extreme top of the upper meniscus. Duplicate determinations were made in each case.

The average results for the three methods were 3.8222, 3.8811, and 3.735, respectively. In each case the result of the Babcock test was slightly higher, and of the Babcock test with glymol lower than that of the Mojonnier method.

**Studies with the Folin and Wu blood sugar determination,** V. E. ROTHBERG and F. A. EVANS (*Jour. Biol. Chem.*, 58 (1923), No. 2, pp. 435-442).—Data are presented emphasizing the necessity in the Folin and Wu method of determining blood sugar of the use of a standard solution containing approximately the same amount of dextrose as the blood filtrate being tested.

**A modified Folin and Wu blood sugar method,** V. E. ROTHBERG and F. A. EVANS (*Jour. Biol. Chem.*, 58 (1923), No. 2, pp. 443-451, fig. 1).—As a means of doing away with the source of error mentioned in the above paper, a slight modification of the Folin-Wu method for the quantitative determination of blood sugar is recommended. The modification consists simply in diluting the unknown solution in the test tube after the addition of the phosphomolybdate-phosphotungstate sugar reagent and development of color until it is approximately the same color as the standard before the colorimetric comparison is made. The variable factor (the amount of dilution) is included in the final formula for calculating the amount of dextrose in the unknown. The apparatus consists of tubes differing from those suggested by Folin and Wu only in that they are longer and are graduated in steps of 2.5 cc. from 12.5 to 50 cc.

**Alcoholic fermentation,** A. HARDEN (*London and New York: Longmans, Green & Co.*, 1923, 3. ed., pp. [5]+194, figs. 9).—This is a revision of the volume previously noted (E. S. R., 34, p. 318).

**Furfural from corncobs.—III, Effect of catalysts on furfural yield in the steam digestion process,** F. B. LAFORGE and G. H. MAINS (*Indus. and Engin. Chem.*, 15 (1923), No. 10, pp. 1057-1060, fig. 1).—To determine whether the yield of furfural from corncobs by the methods described in the previous paper (E. S. R., 50, p. 505) may be increased by the use of catalysts, experiments were first conducted on a laboratory scale. It was found that when hydrochloric, sulphuric, and phosphoric acids were added in amounts sufficient to neutralize the natural base of the corncobs there was a marked increase in the yield of furfural. This is thought to be due to the liberation of organic acids, particularly formic. The direct addition of formic acid brought about a somewhat greater increase in yield than did the mineral acids, and sulphurous acid gave similar results to formic acid. On testing the sulphuric acid catalyst on a semicommercial scale, yields of about 9 per cent were obtained. Since the yield without catalyst was only about 6 per cent, it is considered that the catalytic process offers considerable commercial advantage.

**Observations on milling,** E. S. MILLER (*Chicago: Natl. Miller*, 1923, pp. 127, figs. 39).—The successive topics discussed in this practical treatise are scouring; wheat characteristics; conditioning wheat; heating of wheat; a study of the breaks; primary sifters; middlings purifier; grading and reduction of middlings; flakes, granules, and dust; and overgrinding and scratch rolls,



## METEOROLOGY.

**The climates of the earth**, W. KÖPPEN (*Die Klimate der Erde*. Berlin: Walter de Gruyter & Co., 1923, pp. X+369, pls. 8, figs. 19).—The first part of this treatise deals with general climatology; the second with the geographic system of climates; the third with the climatology of different geographic divisions of the earth—Africa, America, Asia, Australia, Europe, the Polar regions, and the marine areas; and the fourth includes tables showing means and extremes of air temperature and rainfall, monthly means for cloudiness, number of rainy days, humidity of the air, and daily temperature variations. The relation of soil and climate is briefly discussed, but there is practically no reference to the relation of climate and weather to plant growth.

**Relation between climate and plant growth**, E. RUBINSTEIN (*Met. Ztschr.* [Brunswick], 41 (1924), No. 1, pp. 15-17, pl. 1).—The principal feature of this article is a chart which shows for continental Europe the length in days (100-230) of periods with a mean temperature over 5° C. (41° F.) and the northern limits of different kinds of trees—box, plum, apple, maple, linden, and fir.

**[Weather conditions and forest fires]** (*Bul. Amer. Met. Soc.*, 4 (1923), No. 12, pp. 164-173).—Brief summaries and discussions are given of papers presented at the Los Angeles meeting of the American Meteorological Society on Lightning and Forest Fires in California, by S. B. Show; How Weather Forecasting Can Aid in Forest Fire Control, by H. R. Flint; Meteorological Factors and Forest Fires, by J. V. Hofman; Intensive Studies of Local Conditions as an Aid to Forecasting Fire Weather; by G. W. Alexander; Relation of Weather Forecasts to the Prediction of Dangerous Forest Fire Conditions, by R. H. Weidman; and Evaporation as a Simple Index to Weather Conditions, by C. G. Bates.

It is noted that lightning causes about 41 per cent of the forest fires in California and 35 per cent in the northern Rocky Mountain region; that present methods of forecasting are of much value in controlling fires, but that the methods may be greatly improved; that relative humidity is an important factor in forest fire hazard, fires not spreading when the relative humidity is above 60 per cent; that more intensive study of local conditions is much needed as an aid to forecasting fire weather, and that such studies should be made cooperatively by the meteorologist and the forecaster; and that evaporation appears to be a better index of fire hazard than precipitation.

**Damaging temperatures and orchard heating in the Rogue River Valley, Oreg.**, F. D. YOUNG and C. C. CATE (*U. S. Mo. Weather Rev.*, 51 (1923), No. 12, pp. 617-639, pls. 6, figs. 23).—Observations during 1919, 1921, and 1922 in pear orchards, using varying numbers of oil heaters, are recorded and discussed with reference to amount and character of damage done by frost, temperatures maintained by the heaters, and the practical value of orchard heating. Less extensive observations are also recorded for 1923.

The results indicate that the critical temperature for pear blossoms is lower than that generally accepted. The reduction of yield in case of Bartlett and Clairgeau varieties in full bloom was only from 10 to 15 per cent with a temperature below 32° F. for 14 consecutive hours and below 28° for 5 consecutive hours, reaching a minimum of 21.6°. The injury varied with different varieties, but was slight in all cases following a temperature of 25.5° for about 1 hour while the buds were in the pink stage. "It is impossible to name a definite critical temperature for blossoms or fruit at any stage of development, since the duration of the temperature and the preceding



weather and growing conditions must be taken into consideration. Weather conditions on the day following a frosty night also have some influence on the amount of damage." It was found, moreover, to be "much easier to raise the temperature on some nights than on others, but on no night during the three seasons covered by these records was there any difficulty in maintaining the temperature above the danger point, using only a fraction of the total number of heaters available. These records show that it is possible to raise the temperature as much as 8° under exceptionally favorable conditions. However, the average rise in temperature secured with orchard heaters is about 5°." The authors conclude in general that "the effectiveness of the orchard heater, when used properly and in sufficient numbers, in preventing damage to fruit by frost in the Rogue River Valley is no longer open to question." They maintain, however, that "the orchards in the United States that sustain sufficient damage by frost to justify the use of orchard heating equipment make up only a very small percentage of the total acreage in fruit trees."

**Origin and growth of the weather service of the United States and Cincinnati's part therein**, W. J. HUMPHREYS (*Sci. Mo.*, 18 (1924), No. 4, pp. 372-382).—This article briefly reviews the course of meteorology through the ages; discusses somewhat more fully applied meteorology in the United States, especially the development of weather forecasting from the pioneer work of Henry, Maury, and Abbe; and notes the more important present activities of the United States Weather Bureau.

**Monthly Weather Review** (*U. S. Mo. Weather Rev.*, 51 (1923), Nos. 11, pp. 561-616, pls. 13, figs. 4; 12, pp. 617-683, pls. 22, figs. 23).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for November and December, 1923, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 11.—Intensive Studies of Local Conditions as an Aid to Forecasting Fire Weather, by G. W. Alexander (see p. 807); Relation of Weather Forecasts to the Prediction of Dangerous Forest Fire Conditions, by R. H. Weidman (see p. 807); Forest Fire Weather in Western Washington, by G. C. Joy; Lightning and Forest Fires in California, by S. B. Show (see p. 807); How Weather Forecasting Can Aid in Forest Fire Control, by H. R. Flint (see p. 807); Meteorological Factors and Forest Fires, by J. V. Hofmann (see p. 807); Evaporation as a Simple Index to Weather Conditions, by C. G. Bates (see p. 807); Transpiration by Forest Trees (illus.), by R. E. Horton; Notes on the 1922 Freeze in Southern California (illus.), by F. D. Young; Sonora Storms (illus.), by D. Blake; and The Work of the Weather Bureau for River Interests Along the Ohio River, by W. C. Devereaux.

No. 12.—Damaging Temperatures and Orchard Heating in the Rogue River Valley, Oreg. (illus.), by F. D. Young and C. C. Cate (see p. 807); Mountain Snowfall and Flood Crests in the Colorado, by J. M. Sherier; Flood of October 22-25, 1923, in Canal Zone, by R. Z. Kirkpatrick; Is There an Antitrade Wind in the Equatorial Regions? by S. Sarasola; The Development of Meteorology as Illustrative of the Rôle of Mathematics in the Progress of Science, by E. W. Woolard; Using Weather Records, by J. C. Alter; The Weather of 1923 (illus.), by A. J. Henry (see below); and Tropical Disturbances during the Hurricane Season of 1923, by W. P. Day.

**The weather of 1923**, A. J. HENRY (*U. S. Mo. Weather Rev.*, 51 (1923), No. 12, pp. 652, 653, pls. 2).—The precipitation in continental United States was slightly above the average. The year as a whole was a warm one, being the third of a series of warm years, but was not characterized by unduly warm



or cold periods. Tables showing monthly and annual precipitation and temperature departures for different sections of the United States are given.

**Meteorological observations at the Massachusetts Agricultural Experiment Station,** J. E. OSTRANDER and H. H. SHEPARD (*Massachusetts Sta. Met. Buls.* 421-422 (1924), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January and February, 1924, are presented. The data are briefly discussed in general notes on the weather of each month.

### SOILS—FERTILIZERS.

**A new apparatus for mechanical analysis of soils,** H. W. JOHNSON (*Soil Sci.*, 16 (1923), No. 5, pp. 363-366, figs. 5).—In a contribution from the Iowa Experiment Station, a preliminary description is given of an apparatus devised for obtaining a better conception of the physical constituents of the soil. The apparatus is patterned somewhat after the Oden apparatus which, by suspending the soil particles in water and allowing them to settle upon the pan of a balance, records automatically the time required for a definite weight of particles to settle, from which a distribution curve can be computed. It goes farther than this apparatus, however, in that it draws the distribution curve itself, thereby eliminating the complicated calculations necessary with the Oden apparatus. Actual data obtained by the apparatus are presented and discussed.

**The modulus of rupture of a soil as an index of its physical structure,** R. V. ALLISON (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 10, pp. 409-415, figs. 2).—Studies conducted at the New Jersey Experiment Stations on the modulus of rupture of soils in cross bending are reported, and the apparatus used is described and illustrated. Soil samples taken at two-week intervals from a number of the nitrogen-availability plats at the station were subjected to a study to determine the physical changes of the soil that follow season and cropping. The soil is a typical Sassafras loam.

While the soil of the limed plats showed a distinctly superior crumb structure, as interpreted on the basis of the value of the modulus of rupture, additional studies showed that factors other than the direct flocculation of the colloidal material of the soil through the action of the lime applied are active in promoting this condition. The data also indicated that the action of lime upon the soil is distinctly differential, depending apparently upon the nature and type of the soil under investigation. Thus, in a clay soil, the effect of liming was more or less promptly noticeable through the decrease in the modulus of rupture.

In the case of a Sassafras loam soil, on the other hand, the results did not indicate the same effect, the tendency being apparently in the opposite direction. This behavior of lime in the latter soil is thought to explain the anomalous effect of its activity in certain soils where apparently it is quite the opposite of that theoretically expected.

The results of studies obtained through the application of the modulus of rupture tests in connection with work on corrective applications to both natural and synthetic alkali soils showed that the modulus of rupture steadily decreased with the progressive neutralization of the alkalinity. This neutralization was also indicated by the change in color of the test briquets from black to white, the latter color indicating the disappearance or transformation of the alkali.

**The relation between the clay content and certain physical properties of a soil,** B. A. KEEN and H. RACZKOWSKI (*Jour. Agr. Sci. [England]*, 11 (1921),

No. 4, pp. 441-449, figs. 5).—In a contribution from the Rothamsted Experimental Station a simple method is described for measuring various fundamental properties of soil such as pore space, apparent and real specific gravity, volume expansion when saturated, and the amount of water taken up by a unit weight of soil.

Results are given with one soil for six successive depths to illustrate the method. These showed that the apparent and real specific gravities varied inversely with the percentage of clay in the soil, while water absorption, pore space, and volume expansion under saturation varied directly with the clay percentage. The effect on the constants of the larger quantities of organic matter present in the top two layers of soil was, weight for weight, approximately equal to that of the clay, except in the volume expansion results where the effect, if any, was within experimental error. It is considered possible that the fine silt fraction with an upper limit of diameter of 0.005 mm. has effects similar to those of the clay fraction.

**The flocculation of soils, II, III,** N. M. COMBER (*Jour. Agr. Sci. [England]*, 11 (1921), No. 4, pp. 450-471; 12 (1922), No. 4, pp. 372-386).—In the second contribution to the subject (*E. S. R.*, 44, p. 508), studies of the flocculation of soil clay by various reagents, with special reference to three different types of flocculation mechanism, are reported.

The first type is normal or direct flocculation, the mechanism of which is precisely that by which electrolytes coagulate electronegative suspensoids. The second type is indirect flocculation, which takes place whenever the electrolyte reacts with the clay and thereby brings other substances which cause flocculation into solution from the clay. The third type is abnormal flocculation, which is the result of a reaction between the added flocculant and the emulsoid surface of the clay particle.

It was found that the flocculation of clay by calcium hydroxid is not due to the formation of calcium carbonate, it being an action on an emulsoid gel surface and not an action on a sol present in gross amount. The OH ion of calcium hydroxid may perform at least two functions in its cooperation with calcium in the flocculation of clay: (1) When added with or after the calcium ion it produces the alkalinity necessary for the reaction between calcium compounds and silica, and (2) when added before the calcium ion it not only produces this alkalinity but also peptizes the clay with the production of a greater amount of the emulsoid surface, and a consequent increase in the rapidity of flocculation and the volume of the coagulum.

Critical mixtures of clay and silt, in which neither wholly dominated the system, could be obtained by decantation at an appropriate time during the sedimentation of soil suspensions. It was shown that when the clay of such mixtures is flocculated more rapidly than the silt the latter becomes dominant, but that when the silt is flocculated the more rapidly the clay becomes dominant.

The different behavior of clay and of silt to calcium hydroxid is not regarded as due to any essential difference in the structure of these particles, but as being determined by the ratio of the emulsoid surface to the core of the particle. In clay the surface dominates the system, in silt the core dominates the system. In very low concentrations the OH ion appeared to behave normally and to militate against the flocculation of clay by calcium salts.

It is thought that organic emulsoids may in ordinary soils be partly responsible for the anomalous action of calcium hydroxid on clay, but it is shown that calcium hydroxid exhibits that anomalous action on a deep subsoil clay containing no organic matter.

In the third contribution to the subject, studies are reported on (1) the flocculation of particles other than soil particles, (2) the effect of colloidal



silica on the sussenibility of particles (3) the effect of concentration on the relative flocculating powers of calcium hydroxid and calcium chlorid, (4) the relative lime-absorbing capacities of the core and of the colloidal surfaces of soil particles, and (5) the effect of heat on soils.

The results are considered to support and extend the conclusions drawn in the two previous papers. It was found that the only sparingly soluble substances from a random collection examined, the suspensions of which showed the same abnormal flocculation by calcium hydroxid that is shown by clay, were certain phosphates of iron, aluminum, and calcium. The abnormal flocculation of these phosphates is considered to be open to an explanation quite analogous to that already advanced for the flocculation of clay.

Until the amount of calcium hydroxid added to a suspension of clay or phosphate reached a certain amount, its abnormal flocculating power was not manifested. The amount required to produce the abnormal flocculation was greater for a fat clay than for a lean one. This is in agreement with the view that the abnormal flocculation is caused by a coagulation of emulsoid matter, for obviously such coagulation will not become dominant until a sufficient amount of the precipitant has been added.

The lime absorbed by a soil could be wholly and completely removed by a dilute acid treatment which could not very appreciably decompose the unweathered minerals. It is therefore concluded that the absorption of lime by a soil is an absorption by the soil colloids and not by the unweathered minerals.

The ignition of a soil for a few minutes over a Bunsen flame increased the amounts of iron and aluminum dissolved by acid. Evidence is brought to show that this is due to a destruction of the colloids which bind the particles together and a consequent exposure of a larger surface. The effect of a partial ignition on the base-absorbing power of soils and subsoils is described, and the results are claimed to be in agreement with the view that the particles in the aggregates are bound together by gelatinous colloidal matter.

An appendix on the preparation of clay suspensions is included.

**Estimation of colloidal material in soils by adsorption**, P. L. GILE, H. E. MIDDLETON, W. O. ROBINSON, W. H. FRY, and M. S. ANDERSON (*U. S. Dept. Agr. Bul. 1193* (1924), pp. 42).—This is a report of progress made in developing an adsorption method for determining the colloidal material in soils. The method investigated involves determinations of the adsorptive capacities both of the soil and of colloidal material extracted from the soil. The ratio of the two adsorptive capacities multiplied by 100 is taken as the percentage of colloidal material in the soil. Tests of this method on 32 soils are reported, the percentages of colloidal material being calculated from the adsorption of malachite green, water, and ammonia.

The colloidal materials extracted from different soils varied greatly in their adsorptive capacities for malachite green and ammonia, but were much more constant in their adsorptive capacity for water. The percentages of colloids in 13 soils calculated from the adsorption of the three materials agreed, in 14 soils the percentages indicated by the adsorption of two of the substances agreed but disagreed with those indicated by the adsorption of the third substance, and in 5 soils different percentages of colloids were indicated by the adsorption of all three substances.

The two most probable sources of error in the adsorption method of determining the colloidal content of the soil appeared to be the difficulty of extracting a sample of colloidal material which is exactly representative in adsorptive capacity of all the colloidal material in the soil, and the possibility of a change taking place in the adsorptive capacity of the colloid on extraction. An



investigation of these two possible sources of error in the case of several soils showed that the adsorptive capacity for a small sample of extracted colloidal material differed by about 10 per cent from the adsorptive capacity of all the colloidal material which was extractable by the methods employed. However, the colloidal material which could not be extracted had, in many soils, a much lower adsorptive capacity than that which was extractable.

Evidence is presented which indicates that the colloidal material has a somewhat different adsorptive capacity after extraction than it has in the untreated soil. The data indicate that the colloidal material of most soils in its extracted condition is slightly more adsorptive of malachite green, slightly less so of water vapor, and considerably less adsorptive of ammonia than in its condition in the untreated soil.

The errors of sampling and of probable alteration of the colloidal material varied in magnitude in different soils. They were additive as a rule in the case of dye adsorption and tended to balance each other in the case of water or ammonia adsorption. When the adsorption ratios were corrected for possible alteration in adsorptive capacity of the colloid produced by extraction, the percentages of colloidal material indicated by the adsorption of malachite green, water, and ammonia agreed well in nearly all cases with the percentages of colloid determined gravimetrically and microscopically. When no correction was applied for alteration in adsorptive capacity of the colloid, the ratio obtained by the adsorption of water was more accurate in most cases than the dye or ammonia ratio, and approached the true value closely.

A general procedure is suggested for estimating the quantity of colloidal material present in a soil from the relative adsorptive capacities of the soil and of colloidal material extracted therefrom. It is pointed out that the wide discrepancy between the estimates of the colloidal contents of soils given out by various investigators is due in part to differences in definition of soil colloids and in part to faulty methods. The 32 soils tested contained from 6 to 70 per cent of colloidal material—that is, material dispersing into particles less than  $1\ \mu$  in diameter and aggregates of particles less than  $1\ \mu$  in diameter. Thus the placing of the maximum quantity of colloidal material in soils at 2 per cent is considered to be obviously wrong.

**Some factors affecting the evaporation of water from soil**, E. A. FISHER (*Jour. Agr. Sci. [England]*, 13 (1923), No. 2, pp. 121-143, figs. 7).—This is a highly technical analysis of the subject, including a discussion of the results of studies with different soils and with such materials as wool.

It was found, among other things, that the moisture contents of soils at which the rates of evaporation begin to fall off, i. e., at which the vapor pressure of the retained moisture begins to diminish, are characteristic for each soil. They are some function of the total surface of the soil grains, which in turn is dependent upon the average size of the grains. These water contents may therefore be used as a means of characterizing soils. It is stated that in the case of a clay soil the shrinkage due to the content of real clay should be allowed for before making use of the critical moisture content as a means of designating a soil.

**The evaporation of water from soil.—II, Influence of soil type and manurial treatment**, B. A. KEEN (*Jour. Agr. Sci. [England]*, 11 (1921), No. 4, pp. 432-440, figs. 2).—In a second contribution to the subject (*E. S. R.*, 32, p. 815), studies conducted at the Rothamsted Experimental Station to determine the influence of soil type and manurial treatment on the evaporation of water from soils are reported. Two soils were used, one containing about 6 per cent and the other about 15 per cent of clay. Samples were taken of each soil from



unmanured plats and from plats receiving either barnyard manure or complete artificial fertilization.

The rate at which the soils lost water over concentrated sulphuric acid and at a constant temperature was found to depend (1) on the amount of clay present and (2) on the amount of organic material in the soil. The differences due to content of organic material were more obvious in the soil containing the larger amount of clay. The barnyard manure plat lost water at the slowest rate, and the unmanured plat occupied an intermediate position. In the sandy soil the differences in evaporation due to manuring were small.

There was evidence that the moisture equivalent of these soils measures the percentage of water at which the evaporation is first directly affected by the soil particles, and that at percentages of water in excess of the moisture equivalent evaporation is taking place substantially from a free water surface.

**Equilibrium studies of sodium carbonates and bicarbonates in some Idaho soil,** R. E. NEIDIG and H. P. MAENUSON (*Soil Sci.*, 16 (1923), No. 5, pp. 295-320, figs. 6).—Studies conducted at the Idaho Experiment Station to determine the relative absorption factor and also the amount of carbonate salts recoverable throughout stated intervals of time for definite and widely different types of Idaho soils are reported. Special attention was devoted to the equilibrium of sodium carbonate and sodium bicarbonate as affected by these different soil types when in contact for a definite period of time under uniform moisture conditions. The soils were Palouse silt loam, Caldwell silt loam subsoil, and Boise silt loam.

The results showed that absorption increased rapidly from the initial mixing of salts until a maximum was reached, after which the time of contact had little influence upon the percentage absorption of added salts. After equilibrium was reached in the first series, additional salts added to these same soils resulted in an equilibrium similar to that established in the first series. A notable feature of the second series of added salts was that the soils responded to these treatments in a manner similar to that of the first series, and the soils established an added absorption in a similar degree.

The addition of carbonate salts to soils immediately showed a portion of the recoverable salts as bicarbonates. The extent of this change depended chiefly upon the individual soil. Bicarbonate additions to moist soils showed recoverable salts determined as normal carbonate after a short period of contact.

Within the range of concentrations of salts added, these soils showed a greater absorption for the greater concentrations of added salts. While widely different at the beginning of the experiment, when equilibrium was established these soils showed very similar capacities for absorption. Differences of absorption were more noticeable with the soils when the salts were in contact for short periods, indicating that greater absorption took place when the concentration of salts was the highest.

Carbonate and bicarbonate salt treatments to soils maintained in an air-dry condition resulted in much less absorption than with soils maintained at the optimum moisture content. In air-dry soils a part of the carbonates was changed to bicarbonates. Bicarbonate additions were not changed to carbonate in any great degree. It is suggested that a portion of the sodium carbonate not recovered in the water extract, and generally conceded to be absorbed by the soil, is in reality changed to other compounds, thus making it impossible to secure a quantitative recovery.

**A comparison of sand and solution cultures with soils as media for plant growth,** D. R. HOAGLAND and J. C. MARTIN (*Soil Sci.*, 16 (1923), No. 5, pp. 367-388).—In a contribution from the University of California, a brief re-

view is given of various precautions to be taken in interpreting the results of experiments with artificial culture solutions, and additional evidence is presented concerning the importance of taking into consideration the absorption of ions by the plant in planning such experiments. Barley plants grown in solution, sand, and soil under identical climatic conditions are compared with reference to total dry weight, number of tillers, grain production, etc., and a brief résumé of the present theories on physiological aspects of the soil solution is given.

Experiments are reported in which barley plants were grown in culture solutions containing phosphate in very low concentrations maintained approximately constant. Good growth was obtained under these conditions, and analogies to the soil solution are pointed out. Attention is drawn to certain dissimilarities between soil solutions and artificial culture solutions, as the latter are ordinarily employed. It is concluded that there is no evidence from comparative experiments that plants absorb mineral elements from the soil by a mechanism different from that operative in solution cultures. The need for conducting more intensive chemical studies on the subject is pointed out.

**Distribution and importance of soil acidity**, A. GEHRING and F. SANDER (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 6, *Wirtschaft.-Prakt.*, pp. 299-314).—A study of soil acidity and methods for its determination is presented, together with results of cropping studies on soils of different acidities.

The results in general are taken to indicate the extremely variable and as yet unexplained nature of the entire question of soil acidity. It is tentatively concluded that the same or different crops can be differently influenced by the same degrees of acidity, that different kinds of acidity act entirely differently on the same crops, and that under natural soil conditions many other phenomena enter which complicate the entire matter. It is recommended that the variable relation between soil acidity and plant growth be predicted with caution.

**The influence of alkaline soil reaction on plant production**, F. MÜNTER (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 6, *Wirtschaft.-Prakt.*, pp. 289-298).—Studies are reported which showed that the injury resulting from applying large quantities of finely ground calcium carbonate to soil at the time of seeding is smaller on heavy than on light soils. Sugar beets and barley endured considerable alkali and summer wheat somewhat less. Carrots, potatoes, and red clover were sensitive to alkali and flax and yellow lupines were more so. All of these plants were able to endure greater quantities of alkali on heavy than on light soils, with the exception of yellow lupines.

**Analyses of soils of Floyd County [Ga.]**, L. M. CARTER, M. W. LOWRY, W. O. COLLINS, and R. M. SOULE (*Ga. Agr. Col. Bul.* 277 (1923), pp. 72, pl. 1, figs. 4).—This bulletin, supplementing the physical survey of the soils of Floyd County made in cooperation with the U. S. D. A. Bureau of Soils (E. S. R., 45, p. 325), presents analysis of the prevailing soil types of the county and gives information relating to fertility requirements and crop adaptations. The analyses indicate that the soils are somewhat deficient in both nitrogen and phosphoric acid, while potash is present in most of the soils in rather large amounts. The compact silty types of soil are said to show a rather high lime requirement, which in many cases accompanies poor drainage.

**Soil survey of Ashley Valley, Utah**, A. T. STRAHORN ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1920, pp. III+907-937, pl. 1, fig. 1, map 1).—This survey, made in cooperation with the Utah Experiment Station, deals with the soils of an area of 96,000 acres occupying the central part of Uintah County in northeastern Utah. The land in the area is said to consist of a series of gently rolling ridges and numerous intermittent stream



ways. The natural drainage of the area is said to be good except in a few places along Green River and Ashley Creek.

Most of the soils in the area consist of reddish brown to brown fine sandy loams, very fine sandy loams, and clay loams. They are derived from slightly modified old-alluvial sediments laid down by former streams. Including rough broken land and rough stony land, 20 soil types of 7 series are mapped, of which rough broken land, Billings clay, and rough stony land cover 31.2, 12.8, and 12 per cent of the area, respectively. It is stated that the use of excessive quantities of irrigation water has resulted in a high water table and in the water-logging of numerous soil areas of varying extent.

**Representative Transvaal soils.**—V, The Springbok Flats black turf, B. DEC. MARCHAND (*Union So. Africa Dept. Agr. Jour.*, 7 (1923), No. 5, pp. 438-442).—This is the fifth contribution on the nature, origin, and mechanical and chemical composition of the representative soils of the Transvaal (E. S. R., 50, p. 420), and deals with the so-called Springbok Flats black turf, which is a heavy clay soil, black to blue-black in color, adhesive when wet and hard when dry.

The mechanical analyses show the soil to be a heavy clay, the texture of which is improved by the presence of calcium carbonate. The subsoil is practically identical with that of the surface soil.

Chemically these soils are characterized by a high percentage of lime, and they invariably have an alkaline reaction. As a rule they contain reasonably large amounts of potash, but the nitrogen and organic matter contents are not large. While the average percentage of phosphoric acid is said to be relatively high, the available phosphoric acid content is considered to be its limiting factor.

**Some soils of Otago Peninsula,** B. C. ASTON (*New Zeal. Jour. Agr.*, 27 (1923), No. 4, pp. 219-222).—Mechanical and chemical analyses of several samples of soils from Otago Peninsula, which is an area of volcanic origin in the South Island, are presented and briefly discussed.

**Organic matter in the soil,** A. F. GUSTAFSON (*N. Y. Agr. Col. (Cornell) Ext. Bul.* 68 (1923), pp. 14, figs. 11).—Practical information on methods of maintaining and increasing the organic matter content of agricultural soils is given.

**The limits of the accumulation of humus in soils, with particular reference to Nièvre soils,** V. AGAFONOFF (*Compt. Rend. Acad. Sci. [Paris]*, 177 (1923), No. 18, pp. 828-830).—Studies of the humus content of the different layers of two similar soils, one of which was formed apparently 2,000 years before the other, showed that their humus contents were practically the same. This is taken to indicate that the accumulation of humus in a soil has quite definite limits, and that a condition of equilibrium is finally reached between the accumulation of organic matter and its decomposition in soils.

**Rate of decomposition of organic nitrogen in rice paddy soils,** E. H. PANGANIBAN (*Philippine Agr.*, 12 (1923), No. 2, pp. 63-75).—Studies conducted at the experiment station of the College of Agriculture, University of the Philippines, on the rate of carbon dioxid evolution in rice paddy soils simultaneously with the determination of their total nitrogen, ammonia, and amino acid contents before and during the period of growth of rice are reported.

It was found that during the dry season, when the rice paddies were lying fallow, the decomposition of organic matter was slow as measured by carbon dioxid evolution, but there was a large accumulation of ammonia nitrogen. There was an active evolution of carbon dioxid after heavy rains, and nitrification proceeded rapidly, with the consequent conversion of ammonia nitrogen into nitrates. It is stated that the rate of decomposition of organic nitro-



gen can not be measured by the ammonia and amino acid contents of the soil, since they may be transformed into other forms of nitrogen as fast as formed.

Carbon dioxid evolution was active even in submerged soils, but the ammonia present was much less than under aerobic conditions. The evolution of carbon dioxid under aerobic conditions was affected by the moisture content of the soils. A low moisture percentage corresponded to low carbon dioxid evolution, and vice versa. There was an appreciable increase of total nitrogen, presumably caused by nitrogen fixation. The paddies contained practically no ammonia nitrogen under submerged conditions, and nitrates were absent in submerged soils. There was a slight increase of amino acids in the soils under anaerobic conditions, but this increase was not proportional to the increase in total nitrogen.

**Nitrification in Sudan soils**, F. J. MARTIN and R. E. MASSEY (*Wellcome Trop. Research Labs., Chem. Sec. Pub. 29 (1923), pp. 29, figs. 2*).—Studies with alkaline soils at Shambat, north Khartum, to determine the proportion of nitrate commonly present and the changes in this proportion which take place during the season in fallow and cropped soils, and to be used as a basis for methods of applying nitrogenous fertilizers, are reported. The soil was deficient in total nitrogen and organic matter.

Large variations were found in the nitrate content of these soils. The nitrate content of soil samples kept in the laboratory increased on the average about 30 per cent in four months, during which period the increases in the field from which the samples were taken were much greater. Nitrates accumulated in the ridges in irrigated fallow land, but disappeared in dry fallow. The amount of nitrates in the ridges was many times greater than that in the furrows. There was a marked difference between the amounts of nitrates in the ridges and the subsoil due to accumulation of nitrates at the tops of ridges. The amount of the nitrates found at the surface of the ridges was therefore not a proper indication of the amount of available nitrates in the subsoil.

The yields of wheat on unmanured soils were better where the initial nitrate content was high than where it was low. The greatest demand for nitrate by wheat occurred about six weeks after sowing, and, under the conditions of the experiment, ammonium sulphate applied at this stage gave the best results.

When ammonium sulphate was applied to cotton at the time of sowing it caused no increase in the crop. When applied subsequently the greatest increase was obtained from applications made about two months after sowing. Applied at a later date, smaller increases were obtained. Nitrate determinations showed accumulations of nitrate during the growth of the cotton crop.

The flooding of ridges on which nitrate had accumulated, in order to wash the nitrate into the soil, was attempted with some success.

**On the development of a standardized agar medium for counting soil bacteria, with especial regard to the repression of spreading colonies**, H. G. THORNTON (*Ann. Appl. Biol.*, 9 (1922), No. 3-4, pp. 241-274, figs. 13).—Studies conducted at the Rothamsted Experimental Station, the object of which was to increase the accuracy of the plate method for counting soil bacteria, are reported. As a result of this work, a medium which is said to be uniform and reproducible in its results was devised by the use of pure chemical compounds in an agar medium and by selection of such constituents as will not produce a significant change of reaction during sterilization.

Since surface spreading colonies interfere with the accuracy of the results on agar media, a special study was made of a common spreading organism which spreads by active motility. The factors controlling this spread were found to be the existence of a surface film of water on the agar and the rate of multiplication previous to the drying of this film. This rate of multiplica-



tion was greatly reduced on the medium developed, and consequently spreading was greatly restricted.

**Ash soils and their fertilizer requirements,** GEILMANN (*Jour. Landw.*, 71 (1923), No. 2, pp. 53-115, fig. 1).—Studies of the nature and fertilizer requirements of so-called ash soils occurring in the western part of the Province of Hanover, Germany, are reported. These soils are sand soils containing much humus, but are relatively deficient in the important plant nutrients.

They showed a strong absorptive power for nitrogen in the form of ammonia, potash as high-grade potassium chlorid, and phosphoric acid. The highest crop yields were obtained only when potash and nitrogen fertilization was accompanied by liming. These soils did not respond to any marked degree to phosphoric acid fertilization. They exhibited acid properties and were able to decompose neutral salts. The increased acidity resulting from such processes became so extensive that an acidity injurious to plants resulted from complete fertilization which did not include liming. It is concluded that these soils should first be limed and then treated annually with a complete fertilizer containing only a little phosphoric acid.

**Fertilizer experiments, 1922,** S. BALLANTYNE (*Canada Expt. Farms, Kappuskasing (Ont.) Sta. Rpt. Supt. 1922*, pp. 77-83).—The results of the third year of an experiment begun in 1920 to test the effect of various fertilizers on a 4-year rotation of potatoes, barley, clover hay, and timothy hay are presented and briefly discussed.

**The action of Rhenania nitrogen phosphate in comparison with ammonium superphosphate,** A. GEHRING and E. POMMER (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 8, *Wirtschaft.-Prakt.*, pp. 404-407).—Experiments with beets on sandy loam and loam soils to compare so-called lime nitrogen Rhenania phosphate with ammonium superphosphate are reported. The former contained 9.82 per cent of nitrogen and 7.46 per cent of citrate-soluble phosphoric acid.

In one series of experiments lime nitrogen alone did not give as good results as ammonium sulphate, and Rhenania phosphate did not give as good results as superphosphate. The difference between the results given by lime nitrogen Rhenania phosphate and ammonium superphosphate was negligible in some cases, and in others the ammonium superphosphate gave generally better results. The experiments are being continued.

**Recent advances in the production of phosphoric acid for fertilizer and food purposes,** W. H. WAGGAMAN (*Amer. Inst. Chem. Engin. Trans.*, 14 (1921-22), pp. 175-185, pl. 1).—In a contribution from the U. S. D. A. Bureau of Soils, some of the more recent developments in the manufacture of phosphatic fertilizers are reviewed, with particular reference to the pyrolytic method being studied at the Arlington, Va., Experimental Farm. It is concluded that the pyrolytic process is superior to the sulphuric acid process for the manufacture of phosphates for agricultural purposes, but that it is not yet sufficiently far advanced.

**Reaction and phosphoric acid fertilization,** P. EHRENBURG (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 3, *Wirtschaft.-Prakt.*, pp. 129-136).—Studies are reported which showed that with difficultly soluble crystalline, hard, raw phosphates the powerful action of a rather strong physiologically acid reacting fertilization was unable to produce even a moderate availability of the phosphoric acid, in spite of the finely ground condition of the raw phosphate. With the more easily available, soft, earthy, raw phosphates, fineness of division apparently added to the effect of the reaction in increasing availability. When a long time had elapsed after the use of the most finely divided phosphate, apparently the availability of the phosphoric acid was decreased by the action of a physiologically acid reaction.

**Another side of the available phosphate problem,** W. H. WAGGAMAN and H. W. EASTERWOOD (*Chem. and Metall. Engin.*, 29 (1923), No. 23 pp. 1003-1005).—In a contribution from the U. S. D. A. Bureau of Soils, information on processes for the production of available phosphoric acid by the use of hydrochloric, perchloric, hydrofluoric, nitric, and phosphoric acids is presented. It is stated that phosphoric acid is the only mineral acid other than sulphuric acid now used commercially in treating phosphate rock to produce phosphatic fertilizers. It is thought that if this acid could be manufactured at a price materially lower than that which has heretofore been possible, it would be a logical reagent to employ for this purpose. The possibility of producing cheaper phosphoric acid by the pyrolytic process is suggested.

**The effect of certain potassium fertilizers on ammonification, nitrification, and crop production,** S. C. VANDECAVEYE (*Jour. Amer. Soc. Agron.*, 15 (1923), No. 10, pp. 415-427).—Pot culture tests conducted at the Iowa Experiment Station on the effects of applications of manure, lime, and certain potassium fertilizers to Carrington loam soil upon ammonification, nitrification, and crop production are reported.

The results showed that the application of manure and lime stimulated the ammonifying and nitrifying powers of this soil to a marked degree, but that manure alone caused a slight depression in ammonification. Potassium salts, such as potassium chlorid, potassium sulphate, and kainit, caused large increases in nitrification, but exerted only slight influence upon ammonification. The treatments which stimulated the ammonifying and nitrifying powers also caused decided increases in citrate-soluble and water-soluble potassium. This is taken to indicate that a definite relationship existed between bacterial activities and the citrate-soluble and water-soluble potassium. Potassium fertilizers did not show any effect on the citrate-soluble phosphorus, but manure applications did.

The use of potassium fertilizers alone produced increased yields in the wheat crop, but no appreciable increases in the clover crop. Kainit seemed to exert a toxic effect upon clover. Decaying organic matter and bacterial activities, either separately or combined, exerted a striking influence on the liberation of potassium.

**The action of increasing applications of potash on the yield and phosphoric acid content of crops in the presence of soil and fertilizer phosphoric acid,** O. NOLTE (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 1, *Wirtschaft.-Prakt.*, pp. 23-33).—Experiments with potatoes on different soils are reported, the results of which are taken to indicate the possibility that both soil and fertilizer phosphoric acid may be made more available through the use of potash salt, but that this action varies quite widely in different cases.

**Comparative experiments on the action of different applications of chlorin-free and chlorin-holding potash fertilizers on the yield and value of barley and potatoes,** O. LEMMERMANN and K. ECKL (*Ztschr. Pflanzenernähr. u. Düngung*, 2 (1923), No. 8, *Wirtschaft.-Prakt.* pp. 385-394).—Experiments to compare potassium sulphate and potassium magnesium sulphate with kainit and 40 per cent potash salts as sources of potash for potatoes and barley are reported.

The experiments with barley showed that the expensive potash fertilizers containing no chlorin, when applied at the rate of 100 kg. of potassium oxid per hectare (89 lbs. per acre), did not give as good results as the cheaper potash salts containing chlorin. Applications greater than 100 kg. of potassium oxid per hectare did not improve the results, and when they reached



300 kg. of potassium oxid in the form of the potash fertilizers containing chlorin the barley yields were depressed.

All of the potash fertilizers used increased the yields of potatoes, but these increases were not specially large in any case. The more expensive potash fertilizers containing no chlorin did not give markedly superior results when applied at the rate of 100 kg. of potassium oxid per hectare. Where kainit and 40 per cent potash salts were used, less dry matter was produced in the crop than without potash fertilization. Normal potash fertilization had little influence on the starch content of potatoes. Larger applications of the potash fertilizers containing chlorin had a markedly injurious influence on the starch content.

**The variant rôles of soil and subsoil in calcium-magnesium interchange,** W. H. MACINTIRE, W. M. SHAW, and J. B. YOUNG (*Soil. Sci.*, 16 (1923), No. 5, pp. 321-341).—The results of studies conducted at the Tennessee Experiment Station on the annual and 8-year losses of calcium and magnesium, both direct and as a result of subsoil interchange induced by leachings from excessive additions, are reported.

Treatments of calcium oxid, magnesium oxid, calcium carbonate, magnesium carbonate, limestone, dolomite, and magnesite in chemical equivalence at three rates were made to both deep and shallow tanks. Wollastonite and serpentine were also used in deep tanks.

An increase in the additions of calcium oxid increased the losses of calcium salts from both soil and subsurface soil and increased the amounts absorbed by the subsoil. Each lime addition decreased the losses of native magnesium from the surface soil and subsoil. Each magnesium oxid treatment decreased the losses of calcium from the surface soil and caused greater losses of calcium from the subsoil than was leached from corresponding additions of calcium carbonate. The amounts of magnesium leached from the surface and the amounts absorbed by the subsoil increased with the rates of the additions.

The losses of calcium salts from calcium carbonate in the surface soil were found to be independent of the reserves of unabsorbed carbonate for both shallow and deep tanks. Two of the three additions decreased the losses of magnesium from the surface soil, while all three increased those from the subsoil. All three magnesium carbonate additions decreased the calcium losses from the surface soil and increased those from the subsoil.

The leachings from 100-mesh limestone were practically the same for all three rates of addition, and the absorptions by the subsoil were also independent of the rates of addition. The losses of calcium from both shallow and deep dolomite tanks increased with the increase in the rate of treatment. The magnesium losses, however, did not increase with an increase in the rate of additions.

All magnesite treatments decreased the losses of calcium from the surface soil and subsoil and increased the magnesium losses from the subsoil. Wollastonite materially increased the losses of calcium from the surface soil and through the subsoil, and increased the concentration of magnesium in the leachings from the subsurface soil. Serpentine liberated calcium from the deep tank and increased the magnesium concentrations of the deep tank leachings.

It is stated that, as a general tendency, where additions gave a preponderance of one alkali earth the loss of the other was decreased in the surface soil and accelerated in the subsoil.

**Pot culture experiments, 1922,** J. A. VOELCKER (*Rothamsted Expt. Sta., Harpenden, Rpt. 1921-1922*, pp. 69-76, figs. 3).—The progress results of these studies are presented in detail and discussed (*E. S. R.*, 48, p. 323).

Studies on the influence of lead compounds on wheat showed that lead present as chlorid in a soil will produce a toxic effect as soon as the quantity exceeds 0.25 per cent of lead, but that in the forms of oxid, carbonate, and sulphate no harmful influence is exercised up to 1 per cent of lead.

Studies on the influence of chromium compounds on wheat resulted in the general conclusion that, while 0.005 per cent of chromium is not a safe amount to have in a soil for the first year of growth of a corn crop, smaller quantities will prove stimulating rather than harmful, and that 0.005 per cent and even 0.01 per cent will lose its injurious effect in a second year and 0.025 per cent in a third year, a stimulating influence then taking the place of a previously harmful one.

Further studies on the relative effects of lime and chalk on wheat and barley led to the conclusion that lime and chalk do not act similarly in the soil, and that it makes considerable difference whether one or the other be used even though the same amount of calcium oxid is applied. The soil used in the experiments was notably deficient in lime, and the caustic lime proved markedly more effective than the chalk. It is concluded that the method commonly adopted of estimating the lime requirements of the soil by determining only the amount of lime present as calcium carbonate is incorrect.

The results of the second year of studies on the influence of fluorids on wheat showed that germination was hardly affected by 0.05 per cent fluorin, but was markedly so by 0.1 per cent. Much the same general results were obtained as in the previous year, except that the lower quantity of sodium fluorid did not kill but stimulated the plants. The higher quantity, however, killed everything.

The results of the third year of studies on the influence of silicates on wheat indicated that calcium silicate is a far from inactive form of lime.

**Mineral resources of the United States, 1920.—II, Nonmentals, R. W. Stone et al.** (*U. S. Geol. Survey, Min. Resources U. S., 1920, pt. 2, pp. IV+529, pls. 2, figs. 25*).—This publication contains, among other things, sections on Phosphate Rock (E. S. R., 46, p. 219) and on Gypsum, by R. W. Stone; Peat, by K. W. Cottrell; Potash, by M. R. Nourse; and Lime, by G. F. Laughlin and A. T. Coons (E. S. R., 50, p. 724).

**The application of molasses as a fertilizer to cane soils in Mauritius, H. A. Tempany and F. Giraud** (*Mauritius Dept. Agr., Gen. Ser., Bul. 28 (1923), Eng. ed., pp. 33, pl. 1*).—The work of others bearing on the subject is briefly reviewed, and studies on the effect of molasses applications on cane soils are reported.

These show that in virgin cane soils the increase in yield resulting from molasses applications under experimental conditions amounted to about 9.65 tons of cane per acre. Considerations drawn from other experiments indicated that these increases are too large to be attributed entirely to the plant nutrients conveyed by the molasses to the soil.

Laboratory investigations extending over more than one year showed that the addition of molasses to ordinarily rich soils did not increase the rate of nitrogen fixation. The most marked action of molasses applications appeared to be in relation to nitrification. After the molasses was applied this process was entirely suspended, and, in addition, the nitrates primarily existing in the soil disappeared. The results indicated that one of the principal effects of molasses applications is the partial sterilization of the soil, in consequence of which the ordinary soil organisms are for the time being greatly reduced in numbers, while other organisms, notably molds and torulae, are stimulated. Subsequently nitrogen is resumed at an enhanced



rate, and apparently leads to an accumulation of nitrates at the time when they can best be utilized by the growing plant.

The tendency of ammonia and nitrates to revert to insoluble forms is said to be very marked in Mauritius soils. It is considered quite likely that the molasses applications may have the effect of neutralizing applications of nitrogenous fertilizers to some extent by causing their reversion.

**Testing fertilizers for Missouri farmers, 1923**, L. D. HAIGH (*Missouri Sta. Bul.* 209 (1924), pp. 55, fig. 1).—Guaranties and the results of actual analyses of 361 samples of fertilizers and fertilizer materials, representing 143 brands collected for inspection in Missouri during 1923, are presented and discussed. It is noted that the tonnage of fertilizer sold in the State during 1923 was about 5,000 tons less than was listed for the previous year. The tendency toward a reduction in the number of kinds and mixtures is also noted.

**Fertilizer report, January 1 to July 31, 1922**, J. W. KELLOGG (*Penn. Dept. Agr. Bul.* 372 (1923), pp. 91).—This contains the results of actual analyses and guaranties of 1,324 samples of fertilizers and fertilizer materials, representing 751 brands registered by 68 manufacturing companies, and collected for inspection in Pennsylvania during the spring of 1922. Of the total number of samples analyzed, 16.5 per cent were found to be deficient in one or more forms of plant nutrients to the extent of 0.2 per cent or more below their guaranties.

## AGRICULTURAL BOTANY.

**The effect of the plant on the reaction of the culture solution**, D. R. HOAGLAND (*California Sta. Tech. Paper* 12 (1923), pp. 16).—In a previous publication (*E. S. R.*, 42, p. 24) it was shown that in complete or partial culture solutions containing nitrate there is a general tendency for the plant to change the reaction toward the neutral point whether the initial reaction of the solution is acid or alkaline. Subsequent investigations have confirmed this in part, but it has been found necessary to modify the conclusion that the plant does not always cause a solution to change its reaction to a point of becoming injuriously acid.

The reaction of a culture solution is said to have an important bearing on the absorption of ions by plants. The absorption of nitrate ion was found to be favored by an acid reaction, and a relatively increased absorption of cations occurred when an alkaline reaction was present. The reaction on various single salt solutions by the growth of barley, peas, and cucumbers was found to increase the acidity with a number of salts, particularly ammonium sulphate and chlorid, potassium and sodium sulphates, and potassium phosphate, and injury to the plant was produced by the acidity developed.

The importance of considering light, temperature, carbon dioxid, and the carbonate ion in any explanation of the effect of the plant on the reaction of culture solutions is pointed out.

**Influence of temperature and initial weight of seeds upon the growth rate of *Phaseolus vulgaris* seedlings**, W. RUDOLFS (*Jour. Agr. Research* [U. S.], 26 (1923), No. 11, pp. 537-539, figs. 2).—Experiments are reported that were conducted to determine the direct influence of temperature upon the growth curves of plants when as many environmental factors as possible were controlled, and to determine the influence of initial weight of seeds upon the rate of growth of the plants under such conditions. Bean seeds of different sizes were grown in darkness in greenhouse soil with 60 per cent of its water-holding capacity, constant relative air humidity, and constant temperatures of 5, 10, 15, and 20° C.

Under these uniform conditions plants of seeds of a heavier weight showed a decided advantage over plantlets from seeds of light initial weight. Temperature acting as an accelerating factor increased the advantage of plants grown from seeds with a greater initial weight.

### GENETICS.

**A new occurrence of the black-eyed yellow mutation in rats,** H. D. KING (*Science*, 58 (1923), No. 1500, pp. 250, 251).—A light grayish colored mutant female rat with dark red eyes, produced in a litter with 8 blacks by a mating of 2 black rats at the Wistar Institute, is described. The offspring produced by this mutant female mated with a dilute gray male were all wild gray, but when these grays were inbred they produced, among other colored varieties, black-eyed yellow young. By matings of the mutant female with yellow males from the strains of W. E. Castle, it was concluded that this mutation was a cream or nonagouti form of the black-eyed yellow having the formula  $aarr$ , where A equals the agouti factor and R the factor for normal dominant color in black-eyed yellows.

In further matings the parents of the mutant produced 5 creams in a total of 57 young. The sire when mated with certain other black females and certain of his black daughters produced some creams, but in other matings no creams were produced. The appearance of cream young from black parents indicates that both parents were heterozygous for the cream factor. The sire of the mutant, while pure black when young, developed ticked patches on his sides and dark brown hair on his back, and at death one testicle was atrophied. The origin of the mutant factor is suggested as probably in the germ cells of a black rat two or three generations back.

**Bud mutation in the citrus,** L. TRABUT (*Bul. Agr. Algérie, Tunisie, Maroc*, 2. ser., 30 (1924), No. 1, pp. 3-10, figs. 3).—A general discussion in which the author reviews the history of bud mutation in various citrus species, pointing out that mutating forms have been recognized for a long time. Various instances of xenia and fruit mutations are cited.

**Prolific and other dwarf oats: Dominant dwarfness observed in two oat crosses,** T. R. STANTON (*Jour. Heredity*, 14 (1923), No. 7, pp. 301-305, figs. 2).—Eight prolific dwarf oats appeared in the  $F_2$  of Aurora×Pringle Progress oats at the Aberdeen, Idaho, Substation in 1921. The eight plants bred true for dwarfness, with the exception of one row in which two tall plants appeared. The dwarf character is possibly dominant. Practically every culm produced a small panicle with numerous spikelets. The plants were distinctly turf-like, similar to the dwarfs from Victory oats described by Warburton (*E. S. R.*, 40, p. 827). However, this new dwarf is quite early and produces fully ripened grain in abundance, while the Victory dwarf is very late and ripens barely enough seed to reproduce itself.

Data on the progenies of dwarf oats appearing among the  $F_4$  of Winter Turf×Sixty-Day at Aberdeen indicate that the dwarf character is dominant and the tall character recessive, a condition directly reverse to that shown by Warburton in the dwarf plants from Victory. In most characters the dwarfs from Winter Turf×Sixty-Day resembled very closely the Victory dwarfs.

**Studies of subspecific hybrids in *Peromyscus*,** F. B. SUMNER (*Natl. Acad. Sci. Proc.*, 9 (1923), No. 2, pp. 47-52).—Three different crosses between races of deer mice yielding 347  $F_1$  and 296  $F_2$  individuals have been studied with respect to 17 quantitative characters. The results of the study showed no evidence of Mendelian dominance, the hybrids being intermediate in most characters



with similar mean values for  $F_1$ s and  $F_2$ s. The  $F_2$ s, however, showed greater variability than the  $F_1$ s. The coefficients of parent-offspring correlations were +0.3 for all crosses and all characters, but +0.306 between  $F_1$  parents and their  $F_2$  offspring. The mean fraternal correlations were fairly large in both hybrid generations, but there was no correlation between characters entering a cross together except in those known to be related in the parent stock.

The author concludes that the results of the study do not show evidence of Mendelian segregation of size factors, and cites the results of other species crosses dealing with size in animals and birds which likewise failed to show evidence of the operation of Mendelian factors on size. The article is concluded by cautioning against any attempt to universalize the principle of Mendelian segregation in species crosses where size factors are involved.

**Size factors and size inheritance**, F. B. SUMNER (*Natl. Acad. Sci. Proc.*, 9 (1923), No. 11, pp. 391-397).—The author criticizes Castle's views (*E. S. R.*, 49, p. 366) that size factors probably controlling all parts of the body are operative, and presents data indicating that the correlations between different parts of mice were much less when corrected on the basis of uniform body size than the gross correlations. Selected populations of two types of mice also showed small negative correlations between the foot length and tail length. The ability of Mendelian terms to satisfactorily account for size inheritance is questioned, and the importance of taxonomic and geographic variations is suggested.

**Does the inheritance of differences in general size depend upon general or special size factors?** W. E. CASTLE (*Natl. Acad. Sci. Proc.*, 10 (1924), No. 1, pp. 19-22).—In answering the criticisms of Sumner in the above paper, the author furnishes evidence to indicate that general size factors are probably operative which affect the total size of an animal.

**The parallel characters "crossveinless" and "vermillion" in *Drosophila willistoni***, C. W. METZ and R. M. FERRY (*Amer. Nat.*, 57 (1923), No. 651, pp. 381-384, fig. 1).—A brief discussion of the relative locations of the genes for scute, yellow, crossveinless, and vermillion in the chromosomes of four species of *Drosophila*, i. e., *melanogaster*, *willistoni*, *virilis*, and *obscura*, is given. The portions of the chromosomes containing scute and yellow may be homologous, but the authors consider that the distance between crossveinless and vermillion is variable with the species, suggesting a possible rearrangement of the genes.

**Genetic studies on *Drosophila virilis***, C. W. METZ, M. S. MOSES, and E. D. MASON (*Carnegie Inst. Wash. Pub.* 328 (1923), pp. 94, pls. 5, figs. 17).—The mutants which have been observed in genetic experiments with *D. virilis* are described, and the factors causing the mutations are assigned to their locations in the six different chromosome groups as far as possible by means of linkage experiments which are briefly reported in tabular form. The chromosomes and linkage groups in *D. virilis* are also compared with those in the other species of *Drosophila*. The possible rearrangement of genes suggested in the above paper with reference to vermillion and crossveinless may be better accounted for by the action of a crossover modifier, which has been suggested by H. J. Muller in other experiments.

**A note on the effects of temperature on the mutant characters "bent" in *Drosophila virilis* and *D. melanogaster***, C. W. METZ (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 6, pp. 305-310).—Stocks of *D. virilis* and *D. melanogaster* of the bent wing mutation, when reared at a temperature of from 9 to 12° C. at the Carnegie Institution at Cold Spring Harbor, N. Y., have been found to show a disarrangement of the eye facets, giving a roughened appearance to

the eye, whereas the wing and leg modifications due to the bent factor were reduced. The critical stage for the operation of the low temperature was found to be toward the end of embryonic development rather than at first, as eggs kept in an incubator at 23° for 6 days and allowed to complete their development at from 9 to 12° showed the characteristics of flies which had developed entirely in the colder temperature. Changes in the characteristics of the sternopleural and scutellar bristles also occurred in both stocks in the cold, though these changes were not due to genetic differences but were merely the expression of the bent genes under the cold conditions. Such expression was similar in both species.

**Experimental studies on the duration of life.—VIII, The influence upon duration of life of certain mutant genes of *Drosophila melanogaster*, B. M. GONZALEZ (*Amer. Nat.*, 57 (1923), No. 651, pp. 289–325, figs. 15).**—In continuing the studies of the duration of life of *Drosophila* previously noted (E. S. R., 49, p. 667), the author has attempted to locate the factors controlling duration of life in the chromosomes. The work was carried on with 24,287 flies of purified strains from the F<sub>2</sub> of a cross between a wild stock (Old Falmouth) and the stock (Quintuple) having five second chromosome mutations, i. e., black (*b*) body, purple (*pr*) eye, vestigial (*vg*) wing, arc (*a*) wing, and speck (*sp*) wing. Due to crossing-over, the pure strains were produced which are designated in the table below by their mutant phenotypic characters expressed by symbols. As vestigial wing shields arc, it was necessary to test all vestigial flies for this character, and those found heterozygous for arc are designated thus,  $\gamma$ . The following table shows that there were very significant differences in the fertility and length of life of the strains, showing that the various single or combinations of mutant characters apparently affect these conditions:

*Average fertility and duration of life of different mutant strains of D. melanogaster.*

Strain.	Average progeny per fertile mating.	Mean duration of life.			Coefficient of variation.	
		Both sexes (actual number).	Males.	Females.	Males.	Females.
	Number.	Days.	Days.	Days.		
Wild.....	247	39.47±0.28	38.08±0.36	40.62±0.42	33.46±0.75	39.74±0.84
Quintuple.....	44	10.88±.16	9.45±.17	12.12±.25	50.26±1.63	61.90±1.91
<i>b</i> .....	138	40.68±.50	41.03±.53	40.33±.51	34.99±1.02	35.20±1.00
<i>pr</i> .....	325	24.54±.18	27.42±.27	21.83±.23	44.79±.82	49.30±.90
<i>vg</i> .....	53	18.22±.29	14.98±.28	20.98±.40	42.80±1.52	47.45±1.61
<i>a</i> .....	127	26.81±.29	25.20±.33	28.24±.37	39.17±1.05	42.09±1.08
<i>sp</i> .....	103	42.66±.47	46.63±.63	38.91±.65	34.76±1.06	44.52±1.41
<i>b pr</i> .....	247	27.35±.24	30.44±.34	24.06±.32	43.32±.92	55.39±1.20
<i>b vg</i> .....	139	20.78±.25	16.45±.23	24.20±.40	37.02±1.14	44.56±1.28
<i>b a</i> .....	149	21.71±.26	20.11±.36	23.17±.37	54.34±1.58	50.93±1.39
<i>b sp</i> .....	71	31.09±.24	32.36±.35	29.97±.31	37.35±.88	38.18±.84
<i>pr vg</i> .....	109	15.43±.15	11.72±.13	19.05±.27	38.31±.87	48.65±1.23
<i>pr a</i> .....	230	33.71±.34	36.00±.53	31.98±.43	48.40±1.25	51.15±1.18
<i>pr sp</i> .....	247	23.40±.14	23.72±.22	22.96±.19	52.48±.81	50.89±.71
<i>a sp</i> .....	106	36.53±.44	38.41±.58	34.69±.66	39.44±1.21	50.58±1.66
<i>b pr a</i> .....	197	32.50±.34	35.06±.55	30.56±.42	46.86±1.32	49.05±1.19
<i>b pr sp</i> .....	39	27.25±.29	31.22±.45	24.45±.37	43.97±1.19	55.59±1.35
<i>b a sp</i> .....	34	30.50±.39	33.72±.53	26.80±.53	40.78±1.27	48.32±1.70
<i>pr a sp</i> .....	118	39.64±.45	38.38±.62	40.67±.45	43.32±1.33	45.34±1.33
<i>vg a sp</i> .....	71	18.97±.37	12.81±.26	25.20±.61	50.17±1.73	59.95±2.24
<i>pr vg sp</i> .....	116	10.62±.16	9.47±.17	12.17±.26	45.39±1.55	55.61±1.94
<i>b pr vg</i> $\gamma$ .....	135	18.53±.18	14.79±.16	22.18±.29	39.61±.88	47.95±1.11
<i>b vg</i> $\gamma$ <i>sp</i> .....	39	16.70±.25	13.79±.26	19.56±.41	50.26±1.66	54.95±1.90
<i>b pr a sp</i> .....	38	22.92±.28	22.65±.42	23.11±.38	54.84±1.49	57.85±1.49

The author's summary of the effect of the different genes on the length of life in the males, which was substantially the same for the females, was as



follows: " (1) Whenever vestigial is at all present in a strain, the value of the combination is about the same as or lower than that of vestigial alone. This further reduction seems to be dependent on the other mutants present, purple and speck. Black raises the value of vestigial to a slight extent. Vestigial then may be recognized as the most powerful single factor in determining duration of life among the mutants studied. It overshadows the effect of the other characters, although its prepotency, if such we may call it, is not complete. (2) Whenever vestigial is absent, purple is the prepotent gene; that is, when present in combination with the other mutant genes, it tends either to raise or lower the value of the combination to its level. Purple is sensibly raised by black and arc, especially the latter, and lowered by speck. The effect of arc on purple is a little unusual, since arc by itself has a lower mean duration of life than purple. (3) Arc is a strong modifier of the values of the other mutants. It increases the value of purple and lowers that of black and speck, when taken alone. (4) Black and speck, when alone, give flies with long duration of life, longer in fact than the wild males. In combination the resulting strain has a lower duration of life than either component mutant. Their reaction with other mutants has already been noted in the individual discussion of such mutants."

In discussing the results of the study, it is suggested that the duration of life factors associated with mutations, black, purple, vestigial, arc, and speck be respectively designated as duration of life factors 1, 2, 3, 4, and 5. No evidence of crossing over between the length of life factors and their associated morphological factors was observed, and therefore both conditions are probably controlled by the same gene.

**Sex and the development of sex characters**, M. ZAVADOVSKIĬ (*Pol i Razvitie ego Priznakov*. Moscow: [Govt. Ptg. Off.], 1922, pp. 255, pls. 20, figs. 94).—This is a discussion of the factors determining sex and the relation of the internal secretions of the sex organs to the development of secondary sexual characters, based on the results of experiments, mostly with fowls, carried on by the author in Russia. A fairly complete German abstract of the work is also given.

**Further observations on the sex chromosomes of mammals**, T. S. PAINTER (*Science*, 58 (1923), No. 1500, pp. 247, 248).—Cytological studies at the University of Texas, of the behavior of the sex chromosomes have shown that in the opossum the chromatin-nucleolus forms the X and Y or sex chromosomes. A study of the sex chromosomes during spermatogenesis and in the somatic cells of the monkey, *Rhesus maccacus*, has indicated that 48 chromosomes are present in the male, but that those of one pair are unlike. It is assumed that the larger rodlike one is the X-chromosome and the smaller dotlike one the Y-chromosome. Female embryos show 48 chromosomes, but no Y is present.

**Sex reversal and intersexuality**, F. W. R. BRAMBELL (*Jour. Roy. Micros. Soc.*, 1923, No. 4 pp. 395-408).—This is a review of the factors which determine sex in animals, based largely on the works of Geddes and Thomson, R. Goldschmidt, F. A. E. Crew, and F. Lillie. The author seems to conclude that Mendelian factors probably act as a basis for sex determination, but that sex may be further modified or changed by the character of the nutrition, hormones, and perhaps by other environmental conditions.

**Development following castration in animals**, M. KÜPFER (*Landw. Jahrb. Schweiz*, 37 (1923), No. 4, pp. 409-434, figs. 12).—This is a discussion of the effect of castration and spaying on the development of the genital organs, secondary sex characters, skeletal characters, and the habits of such animals.

**Types of mammalian ovary**, L. LOEB (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 8, pp. 446-448).—The guinea pig, rat, and rabbit ovaries are taken as representatives of three types of mammalian ovaries. In the guinea pig all but the very small follicles in the ovary begin to degenerate during oestrus and preceding ovulation, thus only small follicles are left in the ovary after ovulation. The number of follicles rupturing is also usually smaller than in the rabbit or rat. In the rat ovulation is not preceded by a general atresia of follicles, though through the cycle a limited degeneration occurs. Less time would be required for maturation of the follicles in this type than in the guinea-pig type. In the rabbit no atresia of follicles occurred before ovulation, nor does ovulation occur without copulation. There is also a greater development of the interstitial gland (thecae internae) in the rabbit and rat than in the guinea pig.

**The effect of extirpation of the uterus on the life and function of the corpus luteum in the guinea pig**, L. LOEB (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 8, pp. 441-443).—In experiments at the Washington University, St. Louis, Mo., the removal of the uterus from guinea pigs has been found to result in a prolongation for from 60 to 80 days of the corpora lutea produced at the next ovulation, unless hysterectomy occurred immediately after ovulation, in which case the corpora lutea then produced would persist. The removal of only part of the uterus results in the usual length of the periods between ovulations, except that the first period after the operation is slightly lengthened.

**The mechanism of the sexual cycle and the specificity of growth substances**, L. LOEB (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 8, pp. 443-445).—The sexual cycle is divided into two phases, with a possible third, which are probably controlled by different secretions. The first phase is dominated by the maturing follicles which cause various growth processes such as proliferation in the mammary gland, vagina, and uterine wall (prooestrus, oestrus, and metoestrus in some cases). The second phase is dominated by secretions of the corpora lutea which sensitize the uterus and facilitate the development of the fertilized ova and also prevent the recurrence of prooestrus and ovulation. In some animals an intermediate phase also occurs.

**Effects of repeated transplantation of whole suprarenals into young doves**, O. RIDDLE and T. MINOURA (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 8, pp. 456-461).—The effect on sexual maturity, weight, etc., of repeated transplantations of suprarenals into pigeons and doves was studied at the Carnegie Station for Experimental Evolution at Cold Spring Harbor, N. Y. No successful grafts were made, but by repeated transplantations the authors concluded that the effect on the birds should be the same. The results indicated that no significant changes were produced in the offspring of the birds receiving the transplantations, and that practically no changes occurred in the transplanted birds themselves. Seven of the treated birds, however, began reproduction at an average age of 157 days, as compared with 168+ days for the controls, and 204 days for the dams of the treated birds, and 245 days for the dams of the controls.

**The oestrous cycle in the mouse**, E. ALLEN (*Amer. Jour. Anat.*, 30 (1922), No. 3, pp. 297-371, figs. 26).—A detailed study of the macroscopic and microscopic changes occurring in the ovaries, oviducts, uterus, vagina, and vaginal contents during the oestrous cycle in the mouse is reported from the Washington University School of Medicine, St. Louis. The signs of the oestrous cycle in the living animal are described as follows:

During dioestrus the vulva and orifice to the vagina are inconspicuous and closed. The little fluid present is viscous and stringy, and smears show few degenerated epithelial cells with some polymorphonuclear leucocytes. During



prooestrus the vulva is usually red and swollen and the vagina gapes open, containing serous fluid. Smears show only nucleated epithelial cells. During oestrus the vulva and vagina may appear as in prooestrus, but the vaginal mucosa is almost dry. Smears show only nonnucleated, cornified, red eosin-staining cells. During the first half of metoestrus the organs are beginning to return to normal. The smear shows that the cornified cells have been shed in clumps and are very numerous. In the second stage of metoestrus the vulva and vagina have practically returned to normal, the vaginal contents are progressing from a viscous to a fluid consistency, and the smear shows polymorphonuclear leucocytes among the cornified cells.

Histological studies showed that the changes throughout the genital tract were more or less uniform, resulting in a thickening of the epithelial layers during prooestrus, the shedding of the outer epithelial layers during oestrus and the first stage of metoestrus, and the filtering of the leucocytes into the lumen during the second stage of metoestrus and the gradual dissolving of the cornified cells.

In the ovary normal follicles are present during prooestrus and oestrus, and ovulation occurs at the end of the oestrous period, but it is not always spontaneous and in such cases without copulation the follicles disintegrate. The average length of the oestrous cycle as given has been noted from another source (E. S. R., 50, p. 635). The maturation of the follicle from a medium sized stage requires at least one oestrous cycle.

A discussion is also given of the factors influencing the passage of the ova down the uterine tubes, the cause of the oestrous changes, and ovulation.

## FIELD CROPS.

**On testing varieties of cereals,** STUDENT (*Biometrika*, 15 (1923), No. 3-4, pp. 271-293, figs. 3).—Methods of testing varieties of cereals are contrasted and discussed.

The chief difficulty in comparing varieties is held to consist in the fact that the differences to be measured are quite small compared with variations due to soil and weather. The errors due to the soil may be reasonably reduced by the frequent repetition of large plats or growing small (1 sq. yd.) plats with a border of the same variety under a wire cage on a "chessboard" or by means of Beaven's (E. S. R., 48, p. 333) half-drill strip method. It is shown that the last two methods depend for their accuracy on the fact that the nearer two plats are situated the more highly are the yields correlated. A formula due to R. A. Fisher is given for calculating the error of a comparison in a chessboard experiment.

**Student's method for interpreting paired experiments,** H. H. LOVE and A. M. BRUNSON (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 1, pp. 60-68).—Too close an analogy should not be drawn between the determination of exact constants and the results of comparative agronomic experiments, according to this contribution from Cornell University. Bessel's and Peter's formulas do not seem to be adapted to calculating the degree of significance of a difference between two varieties or two comparative treatments in experiments in which the variability within each variety or treatment is high because they extend through a series of years or because of place effect. For observations naturally arranging themselves in pairs, Student's method is held a better method with which to determine the probability of the difference, and deserving of a larger application in the interpretation of agronomic investigations.

**A modification of Student's table for use in interpreting experimental results,** H. H. LOVE (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 1, pp. 68-73).---

The calculated odds for the Z values of Student's table for estimating the probability that the difference between a series of paired experiments is significant and the values for the intermediate classes are tabulated.

**Methods of keeping records of cereal breeding investigations**, J. B. HARRINGTON (*West. Canad. Soc. Agron. Proc.*, 3 (1922), pp. 78-85).—The method of recording the results of cereal breeding investigations at the Minnesota Experiment Station is described, with a brief consideration of certain features of the recording systems used at other American and Canadian institutions.

**Improvement of crop plants by breeding**, J. H. PARKER (*Kans. Agr. Col. Ext. X-Form No. 213* (1924), pp. 4, figs. 2).—Examples of crop improvement by introduction and testing of superior introduced varieties, selection, and hybridization are cited, and the needs are shown for further improvement of certain Kansas crops.

**Water requirements of crops**, W. H. SNELSON (*West. Canad. Soc. Agron., Proc.*, 3 (1922), pp. 63-77, figs. 5).—The mean depth of water found in experiments at the Brooks, Alta., experiment station from 1918 to 1921, inclusive, to produce the maximum yields per acre and the economical depth of application (shown in parenthesis), was for alfalfa 31 in. (6 in.), peas 27 (6), wheat 23 (4), barley 20 (4), oats 19 (4), grasses 18 (4), alfalfa seed 18 (3), potatoes 20 (3), corn 16 (2), and flax 16 in. (4 in.). The quantities given represent the needs of alfalfa, seed alfalfa, grasses, and peas under optimum fertility conditions and the other crops with average conditions of fertility.

**Safer farming in western Kansas**, L. E. CALL (*[Kans. Agr. Col. Ext. X-Form No. 203* (1923)], pp. 4).—Attention is called to the merits of rotating feed crops with wheat, summer fallowing, planting wheat in stubble, and listing for wheat.

**Report from Holly Springs Branch Experiment Station for 1923**, C. T. AMES (*Mississippi Sta. Bul. 220* (1923), pp. 24, figs. 2).—The progress of earlier experiments with field crops (*E. S. R.*, 49, p. 222) is reported on, with suggestions for the production of different crops and comment on dairy possibilities in the section.

Varietal leaders in the tests reported included selections of Lone Star, Delfos, and Trice cotton on valley land and of Express, Triumph, and Trice on hill land; Paymaster, Delta Prolific, and Cocke Prolific corn; Triumph sweet potatoes; and Ootootan soy beans.

Fertilizer tests suggest for cotton under average conditions a mixture of 200 lbs. of acid phosphate, 100 lbs. of sodium nitrate, and 100 lbs. of kainit per acre, or 400 lbs. of a mixed fertilizer containing 8 per cent of phosphoric acid, 4 per cent of nitrogen, and 3 per cent of potash. The yields were highest with the close-spaced cotton and sweet potatoes. Growing soy beans in every row of corn reduced corn yields only slightly, whereas a loss of about one-third was suffered when velvet beans were grown in every corn row.

**[Field crops work in Nigeria, 1923]** (*Nigeria Agr. Dept. Ann. Bul.*, 2 (1923), pp. 80-89, 92-101, 106-117, 125-136).—Experiments (*E. S. R.*, 49, p. 734), reported on from the Ilorin and Moor plantations, by J. R. Mackie and H. B. Waters, respectively, comprise variety trials with cotton, corn, rice, yams, and peanuts, and cultural tests with cotton, corn, and yams. A note on the interpretation of the results of field trials as reported annually in this bulletin, by O. T. Faulkner, is appended.

**[Crop improvement in Bengal]** (*Bengal Agr. Jour.*, 3 (1923), No. 4, pp. 120-126, 133-144, pl. 1).—Besides an article on Jute and How to Improve Its Quality, by N. C. Basu, these pages give summary accounts of breeding work and miscellaneous tests with sugar cane, rice, cotton, and jute.



**Fiber investigations, A. HERNANDEZ** (*Philippine Bur. Agr. Ann. Rpt.*, 22 (1922), pp. 100-108).—The yield of fiber in 35 varieties of abaca (*Musa textilis*) at the La Carlota, P. I., experiment station for seven years ranged from 0.5 to 2.1 per cent, with 28 producing less than 1.5 per cent. Observations showed 10 early varieties to mature in from 16.6 to 26.6 months, 21 early medium varieties in from 26.7 to 36.6 months, and 4 late varieties in from 36.7 to 46.6 months. Days to maturity seem to be correlated with yield, the late varieties being the heaviest yielders of fiber.

Studies on *Agave cantala* and *A. sisalana* showed that, during the first three years after planting, plants grown from suckers produce more leaves, while in the fourth year those from bulbils give more leaves than do those from suckers. *A. cantala* has always produced more suckers yearly than *A. sisalana* up to the fifth year. Notes are also given on other agaves, sansevierias, pineapple, kapok, cotton, and miscellaneous fiber crops.

**The newer ways with textile problems** (*Textile World*, 64 (1923), Nos. 10, pp. 27, 29, figs. 4; 11, pp. 55, 57, 59, figs. 4; 12, pp. 35, 37, fig. 1).—Recent investigations of the properties of textile fibers and yarns and the technique involved in the studies are reviewed.

**Experimental milling tests of adlay, J. F. HAYES** (*Philippine Agr. Rev.*, 16 (1923), No. 3, pp. 197-200, pls. 4, fig. 1).—The methods used and results obtained by the Bureau of Agricultural Economics, U. S. D. A., in experimental milling tests with adlay grain are described, together with suggestions regarding equipment suitable for commercial milling of adlay.

**Irrigation experiments [with alfalfa] at Werribee, L. C. BARTELS** (*Jour. Dept. Agr. Victoria*, 22 (1924), No. 1, pp. 37-42, fig. 1).—In investigations with alfalfa at the State Research Farm at Werribee, best results followed the use of from 24 to 30 in. of water, with applications of at least 4 in. being preferred. The water cost ranged from 703 to 950 tons of water for each ton of dry matter produced. Increasing the amount of water up to 48 in. per acre has induced increased yields, but the return for each unit of water became successively smaller and the heavily irrigated crop had a lower protein content.

**The truth about arghan or pita floja fiber, G. A. LOWRY** (*Textile World*, 63 (1923), No. 6, pp. 11, 12, figs. 5).—Arghan or pita floja (*Ananas* sp.), found wild in the richer lands of Colombia and other countries in tropical America, is said to yield fiber which Belfast spinners spun to 25 leas and reported, weight for weight, stronger than flax, jute, or hemp, with an elasticity of 1 in. per yard, of extraordinary resistance to salt water, and easily dyed. The ultimate fiber is about from 2 to 2.25 in. long. Arghan has been processed with flax spinning machinery without difficulty. The commercial status of the fiber is indicated briefly.

**Some immigrant clovers, A. J. PIETERS** (*Science*, 59 (1924), No. 1515, pp. 39, 40).—*Trifolium striatum*, a species widely distributed in Europe and observed by D. J. Pitts at Bowman, Ga., seemed to be adapted to northern Georgia. Species collected at Snow Hill, Ala., May 13, 1923, by P. Tabor, W. J. Davis, and H. C. Appleton, include *T. glomeratum*, *T. lappaceum*, *T. nigrescens*, *T. resupinatum*, *T. scabrum*, *T. suffocatum*, and *T. tomentosum*.

**Italian red clover seed unsatisfactory in tests** (*U. S. Dept. Agr., Off. Rec.*, 2 (1923), No. 52, p. 4).—Experiments in cooperation with the State experiment stations have shown that Italian red clover seed is unsuitable for any part of the clover area except the Pacific Northwest. In the central Northwest, where winters are severe and the snow cover usually light, northern-grown red clover seed should be used if available, otherwise domestic seed may be used except that from Oregon, which produces a less hardy plant. Chilean, French, and north European seed has given good results in the Ohio and Mississippi



Valleys and in the North Atlantic Coast States. However, where clover diseases, especially anthracnose, are troublesome, the foreign clovers are more likely to lose out on the second crop. In Virginia and westward to Tennessee, where anthracnose is likely to be destructive, efforts to develop local disease-resistant strains should be made. In Oregon, Washington, and Idaho, all strains have done well, the place of origin of the seed seeming to make little difference. Buyers should know the origin of seed and buy from reliable sources, preferably domestic or suitable imported kinds.

**Domestic v. foreign clover seed**, A. J. PIETERS (*Seed World*, 15 (1924), No. 2, pp. 13-15).—A more detailed account of the above work with similar conclusions.

**Effects of selection on the yield of a cross between varieties of corn**, F. D. RICHEY (*U. S. Dept. Agr. Bul.* 1209 (1924), pp. 20, figs. 2).—Comparative yields are reported of different generations of corn under mass selection and of crosses between lines that had been self-fertilized for four generations prior to crossing.

The  $F_1$  generation of Whatley  $\times$  St. Charles White corn was markedly more productive than the average of its parents and slightly more so than Whatley, the better parent. Open-fertilized mass selection failed to maintain this high productiveness, the yields of the later generations approximating the average of the parents. Although it was impossible to retain the efficiency of the  $F_1$  generation of the cross, the method of crossing following by mass selection is said to have established a variety of economic value for the locality.

Strains were isolated by selection within self-fertilized lines which when intercrossed produced as much as the original  $F_1$  varietal cross in a single season's comparison. So far as the work had proceeded, no advantage in yield was had from the laborious methods of hand pollinating over what could have been obtained by growing the  $F_1$  varietal cross each year. The tendency for certain strains to produce satisfactory crosses seems to suggest a more logical basis for future selection and experiment than is provided by the relative vigor of the selfed lines.

**Cotton growing in Kentucky**, E. J. KINNEY (*Ky. Agr. Col. Ext. Circ.* 161 (1923), pp. 12).—Cultural methods and field practices are suggested for growing cotton in Kentucky.

**Cotton in north Brazil**, A. S. PEARSE (*Manchester, Eng.: Internatl. Fed. Master Cotton Spinners' and Manfrs.' Assocs.*, 1923, pp. 130, pls. 4, figs. 48).—Supplementing an earlier work (*E. S. R.*, 47, p. 633), this volume is principally concerned with conditions in the cotton industry in Ceará, Maranhao, and Pará. The world's cotton production and consumption and Brazilian public works against drought are discussed, together with a general summary entitled *Brazil and Her Cotton Potentialities*.

**Annual report of the Indian Central Cotton Committee, Bombay, for the year ending August 31, 1923**, B. C. BURT (*Indian Cent. Cotton Com., Bombay, Ann. Rpt.*, 1923, pp. IV+144).—The activities of the organization involving research and pest control with and the marketing of cotton are summarized for the year indicated. The texts of laws and regulations intended for improvements in cotton marketing and research are appended, together with notes on the cottons of Burma and on progress in the introduction of improved varieties in various provinces.

**The plasticity of cotton and other materials**, F. T. PEIRCE (*Jour. Textile Inst.*, 14 (1923), No. 11, pp. T390-T413, pl. 1, figs. 3).—The plasticity of a material under torsion, i. e., pure shear, is considered a general index to its plastic behavior under extension, bending, or any other type of strain. This has been measured and expressed by observing the way in which the torsional



resisting couple decreases with time when a thread is kept at a constant twist. The method is of broader significance as a measure of the plastic properties of cotton, which largely determine the optimum conditions and the efficiency of preliminary operations, including ginning, opening, scutching, and carding; spinning; yarn qualities; maturing; doubling; mercerizing, bleaching, boiling, and similar processes; finishing processes; and textile qualities.

Observations have been made under ordinary conditions of about 60° F. and 55 per cent relative humidity on yarns of various counts, twists, and varieties of cotton, on bundles of fibers, on the effect of some treatments, and on raw cotton, mercerized cotton, silk, viscose silk, cellulose acetate silk, wool, and other materials. Investigations are in hand on the behavior of cotton over the range of temperature and moisture conditions employed in spinning, manufacturing, and finishing processes.

**A study of convolutions in the cotton hair**, G. G. CLEGG and S. C. HARLAND (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem.*, 2 (1924), No. 31, pp. 370-382, figs. 20).—The number of convolutions in any portion of a single cotton fiber appeared to depend on the ratio of ribbon width to wall thickness. The highest mean number of convolutions per microscopic field is shown when the ratio has the value 3.4 to 3.6. Wetting the fiber caused a partial elimination of convolutions and a lesser elimination of reversals; boiling the fibers under pressure caused an almost complete disappearance of both convolutions and reversals, accompanied by much swelling; and tension caused the pulling out of some of the convolutions, but the reversals remained largely unaffected. On drying or release of tension the fiber tended to resume its original form.

Consideration of data of convolutions per millimeter, reversals per millimeter, ratio of convolutions to reversals, and ratio of right-handed to left-handed convolutions in various types of cotton led to conclusions that no differences exist in the number of convolutions or reversals per millimeter which are capable of producing much effect on spinning quality, but the degree of uniformity of distribution of reversals may be an important factor in spinning. Curves showing the distribution of convolutions and reversals along the cotton fiber indicated that both convolutions and reversals are predetermined during growth in length, and the convolution curves from daily pickings provided further evidence on this point. The results obtained on the mode of distribution of convolutions along the fiber were in substantial agreement with those of Balls and Hancock (*E. S. R.*, 50, p. 629), though direct physiological experiment is held needed for absolute proof of predetermination. The conclusion of F. H. Bowman<sup>1</sup> that a relation exists between the fineness of a cotton and the number of convolutions per unit distance was not substantiated.

The existence of a generalized form of convolution curve is established. This consists of a two-peaked curve with a pronounced dip about the middle of the fiber. To account for the symmetrical shape of the convolution curve, it is suggested that growth in length of the fibers takes place mainly in or near the middle of the fiber.

**A leaf index as a help to the identification of potato varieties**, R. N. SALAMAN (*Nature [London]*, 112 (1923), No. 2825, p. 922).—The first lateral leaflet on the left of the midrib of each leaf is measured and its index,  $\frac{\text{breadth}}{\text{length}} \times 100$ , calculated. The leaf index of a variety must be ascertained from adult leaves on a healthy plant. The variation of the index within any given variety is a normal one and represented by a normal frequency curve. The probable error of the difference of two means of 20 each is 0.7. A dif-

<sup>1</sup>The Structure of the Cotton Fiber. London: Macmillan & Co., Ltd., 1908, pp. XX + 470.

ference of two units in the index may be considered as of significance. Of 65 varieties of which the index was determined, the value of the index ranges between 50 and 72. Neither the place of origin of seed tubers nor the locality where the plants are raised has any effect on the leaf index, provided that the plants are healthy. The leaf index is a constant for each variety.

**Irrigated paddy: A contribution to the study of field plat technique**, L. LORD (*Agr. Jour. India*, 19 (1924), No. 1, pp. 20-27, pls. 3).—Experiments were initiated at Mandalay to determine and to find a way to reduce the error of field trials with irrigated rice.

The yield data showed that under irrigation the yields of plats parallel to the water course tend to increase as the water course is approached. The probable error of a series is only slightly affected by plats distributed in more than one embanked field. Six replications with Student's method modified appeared to reduce the probable error of the difference of two plats to below  $\pm 2$  per cent. The probable error obtained by using total weights was only slightly higher than when using grain weights.

**A tentative study of the effect of root excretion of common paddy weeds upon crop production of lowland rice**, F. DE PERALTA and R. P. ESTIOKO (*Philippine Agr.*, 11 (1923), No. 7, pp. 205-216, figs. 3).—Agronomic and yield data on rice receiving drainage water from cultures of rice, zacate (*Leersia hexandra*), water lily (*Monochoria hastata*), and *Cyperus* spp. indicated that *Cyperus* and water lily excrete substances beneficial to rice growth, whereas the excretions of zacate and, to a lesser extent, rice, are detrimental. It is thought that if water lily and *Cyperus*, both common rice weeds, could be grown in rotation with rice, enhanced grain production would be obtained. Zacate, the most common forage crop in the Philippines, should not be rotated with rice. Thorough plowing and harrowing before planting rice would probably modify the harmful effects of the excretions.

**Selection and improvement of the sugar beet in Spain**, J. M. D. DE MENDIVIL Y VALESCO (*Circ. Hebd. Com. Cent. Fabric. Sucre France*, 35 (1923), No. 1814, Sup., pp. 6).—The methods used and results obtained at the sugar beet improvement and seed production station at Vitoria, Spain, are described. The genealogical method of selection is being used.

While self-pollination was sometimes accompanied by undesirable qualities in seed production and progeny, observations during 10 years oppose the view that selfing is harmful and that it is responsible for the production of inferior and useless types. It is held that morphological characters can not serve as a basis for selection for richness in sugar in the beet. The studies have not shown the existence of an inverse correlation between the weight of the root and richness in sugar.

**Seed production in sugar beets**, V. BARTOŠ (*Ztschr. Zuckerindus. Cechoslovak. Repub.*, 47 (1923), No. 25, pp. 349-353, figs. 3).—Observations on many strains of sugar beets, wherein several forms of premature seed production were seen, led to the statements that families differ in their resistance to cold, that the tendency toward shooting is therefore an individual characteristic, and that the breeder has here the best means to combat the shooting tendency. In thickly seeded or late thinned beets, chilling is not so rapid and premature seed producers are noticeably fewer than with wider spaced beets. Stecklings show under similar conditions much fewer seed producers than normally cultivated beets.

**Premature seed formation in sugar beets**, REJTHÁREK (*Ztschr. Zuckerindus. Cechoslovak. Repub.*, 48 (1923), No. 5, pp. 37-39; also in *Circ. Hebd. Com. Cent. Fabric. Sucre France*, 35 (1923), No. 1814, pp. 619-621).—A striking tendency toward premature seed formation was seen in sugar beets grown in Den-



mark and parts of Sweden in 1923. Cool, damp weather from May 15 to July 1 was followed by much higher temperatures, resulting in rapid root development, which together with hereditary tendencies was probably responsible for high proportion of seed-producing plants. On test plats Swedish seed had 8.4 per cent of seed producers, Zapotil 11.5, Dobrowitz 11.6, Klein Wanzleben 16.4, and Danish seed 32.6.

Cutting off the seed stalks was the principal method advised to lessen the damage. Experiments by the author showed that cutting off the seed stalks reduced losses in weight and in total sugar. Where the stalks were left intact, the shooting beets used up nutrients at the expense of their neighbors and the roots were woody.

O. Fallada cites the studies of V. Bartoš and F. Herles in this connection. Bartoš<sup>1</sup> recommended roguing the beet fields in late June or early July. The early seed producers are said to be the woodiest and to cause trouble at the sugar factory. At this period their removal entails only a small loss, which may be partly made up in the increased growth of adjacent plants. Beets shooting after the period indicated can be ignored, since they do not differ much from ordinary beets in either sugar content or texture.

**Improvement of cane varieties by bud selections**, A. D. SHAMEL (*La. Planter*, 72 (1924), No. 4, pp. 73-75).—Experiments carried on under the auspices of the Hawaiian Sugar Planters' Experiment Station and reviewed in this article, embrace observations on progenies from selected stools of sugar cane, propagation of the selected stools of the superior progenies in new progeny plantings, and selection of stools apparently disease resistant for progeny tests for disease resistance. The technique of selecting stools and comparing progenies is discussed, together with comment on the possibilities of mutations found in the course of the work.

**On some abnormal sugar canes**, T. STEEL (*Nature [London]*, 112 (1923), No. 2825, p. 924).—A series of abnormal sugar canes grown in Australia comprised examples of forking, multiple and suppressed budding, peculiar joints, and regularly malformed joints. It has been observed in Australia that, while striped canes grown from sets reproduce the characters of the parent cane, seedlings from similar canes are always plain without stripes, which may indicate reversion to an original stripeless cane. Wild native cane in Fiji is always either red or yellow but has no stripes.

**Tobacco growing in Cuba**, D. B. PAGUIRIGAN (*Philippine Agr. Rev.*, 16 (1923), No. 3, pp. 174-196, pls. 11, fig. 1).—The Cuban industry is described in detail for the benefit of the Philippine grower.

**Note on the occurrence of double embryos in wheat grains**, W. L. WATERHOUSE (*Nature [London]*, 112 (1923), No. 2825, p. 924).—Among germinating wheat grains of the Yandilla King and Federation varieties two kernels were found, each having two embryos. Each gave rise to two shoots and six seminal roots.

**Report of seed tests for 1922 and 1923**, J. L. BURGESS (*N. C. Dept. Agr. Bul.*, 1924, Jan., pp. 6).—Tables show the analytical work of the North Carolina seed laboratory from November 1, 1922, to November 1, 1923. A total of 1,391 samples of seed were examined during the period.

**Report of seed control in Belgium** (*Rev. Gén. Agron.*, n. ser., 14 (1924), No. 1, pp. 1-12).—The average germination and purity of 829 samples of agricultural seed tested at the Seed Control Station at Louvain during the year ended June 30, 1923, are tabulated and discussed.

---

<sup>1</sup> Über die Rübe und Ihre Veredelung. 1904.

## HORTICULTURE.

**Plant forcing**, A. M. DANVIG (*Plantedrivning. Copenhagen: N. C. Roms, [1921], pp. 251+[5], figs. 108*).—This book contains general information relating to the construction of glasshouses and forcing beds for the growing of fruits and vegetables.

**Diseases and insects of garden vegetables**, W. W. GILBERT and C. H. POPENOE (*U. S. Dept. Agr., Farmers' Bul. 1371 (1924), pp. 11+46, figs. 65*).—A publication of general nature, in which various important diseases and insect pests of the garden are discussed in respect to their appearance, methods of attacking plants, nature of injuries caused, and best preventive treatments. In addition to presenting directions for the preparation and application of common fungicides and insecticides, miscellaneous control methods such as soil sterilization, soil liming, carbon disulphid treatment, growing of trap crops, and the encouragement of beneficial insects are briefly outlined.

**Economic results in the pollination of greenhouse tomatoes**, A. G. B. BOUQUET (*Oregon Sta. Circ. 55 (1924), pp. 16, figs. 4*).—This circular, consisting in part of information already presented in a previous bulletin (*E. S. R.*, 40, p. 833), now out of print, and in part of data obtained in continued studies along the same lines, describes methods of hand-pollination and emphasizes the value of the practice for increasing the yield of glasshouse tomatoes.

That uniform results are obtained from hand-pollination was indicated in yield records taken on 204 plants, divided into 4 plats, the total yield per plant for the 4 areas averaging 11 lbs. 7 oz., 11 lbs. 14 oz., 10 lbs. 2 oz., and 11 lbs. 14 oz. A study of the yield of high and low producing plants showed that high yield is directly correlated with a larger number of fruits and not with the weight of individual fruits. That hand pollination has a beneficial effect on earliness of fruit was shown in the fact that 16 hand-pollinated early fruiting plants produced an average of 39 per cent of their total fruit in their first harvest month, while 21 naturally pollinated plants averaged only 15 per cent of ripe fruit in the same period. Under normal pollinating conditions about 64 to 70 per cent of all blossoms will produce marketable fruits. Observations on the fruiting performance of 9,473 blossoms representing 1,100 clusters showed 65 per cent fruitfulness.

**The preparation of spray materials**, R. H. ROBINSON (*Oregon Sta. Bul. 201 (1924), pp. 15, fig. 1*).—This bulletin outlines methods of procedure for the preparation of sprays, emphasizes precautions that should be taken in the selection of materials from which the sprays are prepared, and advises on safe mixtures that may be used in combination sprays. Methods are given for the preparation of lime-sulphur solution, self-boiled lime sulphur, Oregon cold-mix lime and sulphur, New Jersey dry-mix lime and sulphur, Bordeaux mixture, Burgundy mixture, "boiled" lubricating oil emulsion, and three different formulas for "cold" lubricating oil emulsions.

**Feeding trees independent of root system**, J. H. GOURLEY (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), p. 100).—In connection with a general study to determine the causes of the deleterious effects of grass sod upon fruit trees, nutrient solutions were supplied to the tree trunk in three ways, namely, (1) by insertion of glass tubes into the tree trunk, (2) by inarching a young tree whose roots were growing in a tub, and (3) by grafting a supplementary root into the trunk. See also a previous note (*E. S. R.*, 50, p. 299).

**Oldenburg as female in apple crosses**, C. S. CRANDALL (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 13-19).—Information of a statistical nature is given upon the results of hybridization experiments in which the Oldenburg apple was crossed with several standard varieties and with various crablike forms.



As an ovule parent the Oldenburg was found to be very satisfactory, the flower buds being large and the stamens easily removed. A large number of seedlings resulted from the crosses.

**Nitrogen and carbohydrate composition of the developing flowers and young fruits of the apple,** F. S. HOWLETT (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 31-37).—Determinations of the amount of nitrogen and carbohydrates contained in the expanding flowers and young fruits of the Roxbury Russet apple showed important changes in relation to the stage of development and in the case of fruits whether they were about to set or to drop. The moisture content of flowers in full bloom was 83.35 per cent, that of the petals being 87.69 and of the receptacles 80.17 per cent. Young fruits about to abscise contained much less moisture than fruits which were going to stick. The nitrogen content, computed upon the dry weight basis, was rather high when flowers were expanding, followed by a small decrease to a value slightly more than 4 per cent, which was maintained until the petals had fallen. There was practically no change in nitrogen content in setting fruits, while in those about to drop the nitrogen declined to approximately 3 per cent. The free reducing substances increased to high values with the enlargement and growth of the apples, but declined to a comparatively low level in those fruits which survived the first drop. Upon the dry weight basis there was a distinctly greater amount of free reducing substances in fruits which were going to abscise, although the individuals which were going to stick contained a greater amount because of their larger size. The data show that free reducing substances made up the larger part of the total sugars. The decrease in free reducing substances in those fruits which were going to stick was not accompanied by an increase in the total sugars.

**Oxidase activity in varieties of apples,** B. D. DRAIN (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 25-30, figs. 5).—That oxidase activity is rather closely localized in the fruit of many apple varieties was indicated in studies conducted at the Massachusetts Experiment Station, where the cut surfaces of many varieties were treated with reagents, including violamin, guiacum gum, and benzidin. Of the three reagents tried, the last named proved most satisfactory in point of cost, ease of handling, and in furnishing satisfactory photographic material. Tests made at various seasons, during the time of fruit development, at harvest, and late in the storage season, enabled the author to divide varieties into three groups according to the location of the oxidase activity. The majority of the varieties fell in that class where the greatest activity was noted in the vicinity of the core and core line. Similar experiments conducted with pears, quinces, and crab apples gave less satisfactory results.

Apples in which the basin end was covered with paraffin retained their flavor much longer than untreated specimens, leading the author to believe that oxygen may enter largely through the fibrovascular bundles which connect the calyx tube and the core cavity. Pears in which the basin end was sealed with paraffin did not core rot until decay had gained access from the torus part of the pear.

**Storage of starch in the pear and apricot,** S. H. CAMERON (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 98-100).—Microchemical tests of the wood up to 6 years of age from lightly and severely pruned Bartlett pear and Royal apricot trees growing at Davis, Calif., showed that nonheaded trees begin the storage of starch earlier in the spring than do headed trees. The difference was more noticeable in the 2- and 3-year-old wood, and was also more evident in the apricot than in the pear. Two minima and two maxima for starch were observed, occurring at approximately the same time in both the pear and the apricot. Little difference was observed in the relative amount of stored starch in the younger portions of the nonheaded and headed



trees. However, in the older portions of headed trees there was relatively less starch than in corresponding portions of nonheaded trees. In the apricot the bulk of the starch was stored in the medullary rays and bark, while in the pear the starch occurred in the pith, medullary rays, and wood parenchyma. At the beginning of growth renewal in the spring starch disappeared first from the tips of the shoots, then progressively downward into the older parts of the branches.

**Peach culture in Missouri**, H. D. HOOKER, JR. (*Missouri Sta. Bul.* 207 (1923), pp. 14, figs. 12).—Asserting that peach growing in Missouri is at the best a hazardous proposition on account of the frequent warm periods often occurring during the winter season, the author discusses various pruning and cultural practices which have been found to reduce freezing injuries, presenting (1) earlier work by the station (*E. S. R.*, 32, p. 42), which indicated that peach buds entering the rest period late in the fall have a corresponding tendency to delay resumption of growth in the spring, (2) recent studies at Columbia, which showed much higher percentages of survival following cold waves in Mayflower and Alton peach buds located on the basal end of long shoots, and (3) pruning investigations at Turner Station, in which it was shown that the number of buds developing upon main branches of Elberta trees was markedly decreased by summer heading and appreciably increased by winter heading except when followed by summer heading.

The author suggests that under Missouri conditions the peach may be best pruned by utilizing a combined heading and thinning process soon after the trees have blossomed, the severity of the pruning being in accord with the blooming performance of the tree; that is, heavily blooming trees should be heavily pruned, lightly blooming trees lightly pruned, etc. Under conditions of no bloom, peach trees should be cut back to the two-year wood. Where blooming time pruning is impracticable, it is advised that trees be headed during the winter and thinned out in June.

Since fall tillage tends to promote late vegetative development, such practice is advised only for southern Missouri conditions. Preliminary results of a test at Columbia upon the seasonal effect of nitrate of soda upon shoot growth and fruit setting indicated that in orchards in moderately good condition nitrate of soda applications may be delayed until the danger of killing frost is practically over. Fruit thinning is advised whenever the crop is heavy. In connection with the spray calendar, information is presented upon the preparation of self-boiled lime sulphur, the amount of spray solution required for individual trees of various ages, and the use of paradichlorobenzene.

**Grape growing in Missouri**, H. G. SWARTWOUT (*Missouri Sta. Bul.* 208 (1924), pp. 36, figs. 19).—Detailed directions are presented for the selection of a vineyard site, the choice of varieties, propagation, planting, trellis construction, pruning and training, cultivation, fertilization, harvesting, combating of various pests, and the preparation and application of spray materials.

**Viburnum americanum as a garden fruit**, G. M. DARROW (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 44-54).—Observations upon the fruit of a collection of selected forms of *V. americanum* assembled at East Lee, Mass., by A. E. Morgan indicated considerable variation in the time of ripening, size of cluster, size of berries, and the acidity and pectin content of the fruits. Jelly made from *V. americanum* fruits was found to be of excellent quality, although of a peculiar flavor which does not appeal to everyone. Information is presented upon the acidity and pectin content of various strains, upon methods of propagation, and upon the soil and cultural requirements of the plant.

**Tea investigations**, R. DU PASQUIER (*Bul. Econ. Indochine, n. ser.*, 26 (1923), No. 162, pp. 429-447, pl. 1, figs. 4).—This is a report upon miscellaneous



studies carried on with the tea plant at the Phu-Tho [Indo-China] Agricultural and Forestry Station. Acclimatization tests with 24 varieties of tea showed wide variations in the adaptability to the environment. Forms from Cochin China, Munjpur, and Assam showed considerable promise. A tea known as Moyen-Tonkin was found especially vigorous and capable of growing on poor soils, but was, unfortunately, decidedly polymorphic, eight distinct types being isolated and described. Seeding, transplanting, spacing, pruning, and fertilization tests are discussed.

**The pecan nut (*Carya olivaeformis*)** [in South Africa], R. McILWAIN (Rhodesia Agr. Jour., 21 (1924), No. 1, pp. 59-61, pls. 2).—Six pecan trees imported about 1913 from the United States have made very satisfactory growth and produced nuts of excellent quality.

**Perennial flowers for North Dakota homes**, A. F. YEAGER and F. M. HEATH (North Dakota Sta. Bul. 170 (1923), pp. 56, figs. 27).—Based on station records and those kept on a private flower garden near Grand Forks and upon replies to questionnaires sent out to various parts of the State, popular information is presented upon the comparative hardiness, cultural requirements, and characteristics of a large number of perennial flowering plants which have proved their adaptability to North Dakota environments. Many of the species are illustrated.

## FORESTRY.

**The biotic factor in forestry**, E. N. MUNNS (Sci. Mo., 18 (1924), No. 3, pp. 322-330, figs. 4).—This is a popular article in which the author points out the intimate relation existing between animals, including man, and forest plant life.

**Our softwood timber**, W. B. GREELEY (Mil. Engin., 16 (1924), No. 86, pp. 89-94, figs. 8).—A general article in which the author gives information concerning the softwood supplies of the United States and emphasizes the necessity of protecting softwood forests from entire depletion.

**The source of Scotch pine seed for northern Swedish plantations**, G. SCHOTTE (Meddel. Statens Skogsförsöksanst., No. 20 (1923), pp. 305-400, figs. 47).—In order to determine the value for northern Swedish conditions of Scotch pine seed obtained from more favorable seed-producing regions, material was gathered from carefully selected parent trees in various regions of Sweden representing different average temperatures during the months of June to September.

Data taken on the resulting seedlings showed that, in respect to survival, best results were obtained from plants raised from seed obtained in the same zone as the plantations. The next best results were procured from seed obtained in the neighboring warmer zone. Differences were noted, however, in lots from the same zone. As in the case of survival, the greatest gains in height growth were in those plants raised from seed obtained in the same zone as where planted, with those from seed of the neighboring, warmer zone second. Resistance against *Phacidium infestans*, the most injurious enemy of pine culture in Norrland, was found to be considerably greater in northern stocks than in those from southern Sweden. Observations on the longevity of the needles, commonly supposed to live longer on northern strains, failed to show any material differences, leading the author to conclude that the longevity of needles is determined by climatic conditions and is independent of the source of the seed. In the north needles live three to four years, while in southern Sweden their life is approximately two years.

As practical deductions, it is suggested that seed for the establishment of Scotch pine plantations be secured from the same temperature zone, or at least

from a zone not more than 1° C. warmer in respect to average summer temperature. It is suggested that good results would likely be obtained with seed coming from colder localities.

**The relation of white alder to soil improvement**, E. ROSSEELS (*Bul. Soc. Cent. Forest. Belg.*, 29 (1922), No. 9, pp. 515-520, figs. 2).—Canada poplars, among which white alders were interplanted, were found to have an average circumference of 44 cm. as compared with 29 cm. for poplars planted among willows. Observations upon European ash trees growing under similar circumstances showed similar favorable influences on the part of the alders. It is believed that the beneficial effect of the alders is due to the abundance of root nodules, which are supposed to be able to extract nitrogen from the air.

**The hornbeam (*Carpinus betulus* L.) in Britain**, M. CHRISTY (*Jour. Ecology*, 12 (1924), No. 1, pp. 39-94, figs. 9).—This species, of restricted distribution in Europe and England and long confused with maples and elms, is discussed in respect to its place in literature, historical associations, distribution in Britain, botanical characters of the tree and the wood, uses of the wood, and its insect and fungus enemies.

**Tree studies at the Mustila Arboretum**, A. F. TIGERSTEDT (*Acta Forest. Fennica*, 24 (1922), pp. 1-34, figs. 2).—This is a detailed report upon the behavior in Finland of a large number of native and introduced species of evergreens, all of which were 20 years of age at the time of the observations. Of the exotic species, those coming from western North America but not near the Pacific coast seemed to be most promising.

**Forestry in Finland**, O. HEIKINHEIMO and E. SAARI (*Acta Forest. Fennica*, 19, (1923), pp. 1-42, pls. 5, figs. 9).—An article of a general nature presenting information concerning the extent and nature of the forests, nature of the forest lands, ownership of forests, forest administration, State forest management, and the significance of the forests of Finland in respect to the nation's trade balance, etc.

**Report of the State department of forestry, University of Maryland, for 1922 and 1923**, F. W. BESLEY ET AL. (*Md. State Dept. Forestry Rpt.*, 1922-1923, pp. 78, pls. 5, fig. 1).—This is the usual biennial report (*E. S. R.*, 47, p. 41) and is comprised largely of administrative information.

**Annual progress report on forest administration in the Province of Bengal for the year 1922-23**, R. C. MILWARD (*Bengal Forest Admin. Ann. Rpt.*, 1922-23, pp. II+47+3).—This is the usual annual report (*E. S. R.*, 49, p. 441).

**Annual progress report on forest administration in the Province of Bihar and Orissa for the year 1922-23**, A. R. DICKS (*Bihar and Orissa Forest Admin. Ann. Rpt.*, 1922-23, pp. [70]).—This report, like that of the preceding period (*E. S. R.*, 49, p. 643), contains general administrative information.

**Lumber and its uses**, R. S. KELLOGG, rev. by F. H. SMITH (*New York: U. P. C. Book Co., Inc.*, 1924, 3. ed., rev., pp. XI+370, figs. 99).—This edition (*E. S. R.*, 43, p. 344), prepared in simple nontechnical language, presents information concerning the properties and uses of various important American forest species which are manufactured into lumber.

## DISEASES OF PLANTS.

**Plant disease and pest control**, W. T. HORNE, E. O. ESSIG, and W. B. HERMS (*California Sta. Circ.* 265 (1923), pp. 1-60).—Popular descriptions are given in these pages of fungus, bacterial, and physiological diseases and insect pests of numerous economic plants, with suggestions for their control. The material is arranged alphabetically according to the common names of the host plants.



**Cytological studies of infection of Baart, Kanred, and Mindam wheats by *Puccinia graminis tritici* Forms III and XIX, R. F. ALLEN** (*Jour. Agr. Research* [U. S.], 26 (1923), No. 12, pp. 571-604, pls. 7).—This paper is in continuation of a series of investigations undertaken to determine the nature of immunity, an account of previous work having already been noted (E. S. R., 49, p. 45).

Inoculation experiments are reported with two forms of black stem rust on varieties of wheat, Baart being susceptible to the specialized Forms III and XIX, Kanred susceptible to Form III and immune from Form XIX, and Mindum immune from Form III and resistant to Form XIX.

Appressoria of both forms of rust are said to secrete some substance which penetrates the walls of the guard cells on which they lie and spreads through them, sometimes reaching the next cells. This substance softens the cell walls and kills the cell contents. It is claimed to produce the minimum of injury to the stomata of Baart, is intermediate in its effect on Kanred, and strongest in its action on Mindum. The effect on the stomata is said to be independent of susceptibility and immunity.

Form III was found to develop normal haustoria in Baart and Kanred and to obtain food for growth. In Mindum it forms haustoria, and when the young fungus forms a haustorium in a mesophyll cell, the living contents of that cell are said to flow rapidly to the haustorium, condense around it, and die, and the whole cell collapses. Each attempt of the fungus to make a haustorium wastes some of its substance as the living matter is continually transferred to the growing tips, leaving the older hyphae empty. The host tissues in Mindum for some distance around the fungus are said to be plasmolyzed, and an occasional cell wall is greatly swollen.

Form III is considered to secrete substances into the host cells. Baart and Kanred tissues are stimulated and produce additional food that meets the needs of the fungus, while Mindum tissues are killed outright by the more concentrated solution of this substance. The outer regions of the infection in Mindum were said to be slightly stimulated, but it was not clear whether this was due to a dilute solution of the same toxin that killed the central cells or to secondary substances which were formed in the dying cells and diffused from them.

**The intracellular bodies associated with the rosette disease and a mosaic-like leaf mottling of wheat, H. H. MCKINNEY, S. H. ECKERSON, and R. W. WEBB** (*Jour. Agr. Research* [U. S.], 26 (1923), No. 12, pp. 605-608, pls. 8).—A brief description is given of the intracellular bodies found in wheats affected by the rosette disease and the mosaic-like mottling.

The intracellular bodies in wheat are said to be similar to certain of the intracellular bodies associated with other plant diseases and with certain animal diseases, but they differ in a number of particulars from certain others which have been described in diseased tissues. In general, the intracellular bodies are said to resemble the cell inclusions of unknown nature which are associated with some of the virus diseases of animals.

**Stem and root rot of peas in the United States caused by species of *Fusarium*, F. R. JONES** (*Jour. Agr. Research* [U. S.], 26 (1923), No. 10, pp. 459-476, pl. 1, fig. 1).—The author has studied a destructive stem and root rot of peas which he has found due to *F. martii pisi* n. var. This variety is said to be widely distributed throughout the pea-growing districts of the United States, but the injury which it causes is less important than that caused by *Aphanomyces* sp. Several species of *Pisum* have been found subject to the disease, the most susceptible portion of the plant being the base of the stem just



above the attachment of the seed. The fungus entering seedlings at this point may invade the vascular system and produce a wilt, but older plants are rarely so affected. The small rootlets are invaded and killed. A comparatively high soil temperature and soils containing much organic matter are believed to favor the persistence of the fungus.

No evidence was obtained indicating that the fungus was disseminated through the seed. On account of its wide distribution and the variability in the pathogenicity of cultures, it is thought to be a widely disseminated soil organism having physiological varieties of varying degrees of pathogenicity.

Some slight resistance to the fungus was observed, but the resistance is so small that further work will be required before varieties of commercial importance are found.

**Control of potato tuber diseases**, M. SHAPOVALOV and G. K. K. LINK (*U. S. Dept. Agr., Farmers' Bul. 1367 (1924), pp. II+38, figs. 39*).—Descriptions are given for the recognition of a considerable number of diseases of the potato tuber, with suggestions for their elimination and control. This publication is a revision of Farmers' Bulletin 544 (*E. S. R., 29, p. 549*).

**Pod and stem blight of soy bean**, S. G. LEHMAN (*Ann. Missouri Bot. Gard., 10 (1923), No. 2, pp. 111-178, pls. 5, figs. 13*).—A disease herein called pod and stem blight of soy bean has been studied and described. The disease, which is not known to be widely distributed, having been found to date in three localities only, all in North Carolina, occurs on pods, stems, and infrequently on leaves, causing a premature death of plants, a failure of young ovules to develop, and a molding and decay of seeds in later stages of development. The causal organism is believed to have been hitherto undescribed. Its characters place it in the genus *Diaporthe*, and it has been assigned the name *D. sojae*. It has been isolated from stems, pods, and seeds, and has been observed to cause the death of very young seedlings by growing from the seed coat to the hypocotyl and causing it to decay. Successful inoculations have been made in the field and greenhouse, and the organism has been recovered from plants diseased as the result of artificial inoculation.

The organism overwinters on stems and in seed. Pycnospores are produced in abundance in the spring on diseased stems, and diseased seed have yielded isolations in April and May. Infection and dissemination depend largely on humidity. Certain changes occurring during growth of mycelium in a nutrient solution containing inorganic salts and glucose have been followed.

**The mosaic disease of sugar cane**, C. G. HANSFORD (*Jamaica Dept. Agr., Microbiol. Circ. 2 (1923), pp. 14, pl. 1*).—This is said to be chiefly a revision of a circular published by S. F. Ashby and distributed in 1920 and 1921.

It is thought possible that mosaic diseases may be caused by something similar to certain very minute reproductive bodies described by Löhnis and Smith (*E. S. R., 49, p. 221*).

Only one method of transmission of mosaic has been shown to occur, and *Aphis adusta* (*A. maidis*) acts as carrier in this case. Measures recommended for control depend upon the facts that the disease is always transmitted in tops cut from affected stalks, that infection is transmitted by some aerial agency from diseased to healthy plants, and that infection is not retained by the soil.

**Indications respecting the nature of the infective particles in the mosaic disease of tobacco**, B. M. DUGGAR and J. K. ARMSTRONG (*Ann. Missouri Bot. Gard., 10 (1923), No. 3, pp. 191-212*).—This paper deals more particularly with some of the problems relating to infectious chlorosis, with special emphasis on that type illustrated by the mosaic disease of tobacco.



Continuation and repetition of the work previously noted has corroborated results formerly obtained (E. S. R., 47, p. 752), pointing to an infectious particle of a size approximating that of fresh 1 per cent hemoglobin.

An elaborate cytological study, by means of procedure briefly indicated, of healthy and diseased tobacco and tomato tissue, healthy bean tissue, and healthy cucurbit tissue regarding the probable nature of such a particle shows that the infective particles (which have a phenomenal power of migration, attaining quickly almost complete distribution in the tissues) do not withstand complete dehydration, though they are not apparently so sensitive to reagents and conditions as would be expected in case of a living structure so pliable and attenuate. The virus of mosaic appears less resistant than do certain spore forms of the bacteria. Grinding is escaped to a considerable degree. Various experiments on temperature relations and the effects of light and disinfectants reveal no unusual characters in the mosaic agency, and the same is true of studies *in vitro*.

Filtration experiments begun in 1921-1922 have yielded some results of striking interest, and these were set apart to be published separately. The virus has, however, shown no activity and no stage having microscopic dimensions.

Regarding the graft-transmissible forms of mosaic, reference is made to the report by Blakeslee (E. S. R., 47, p. 525). Reference is made also to other recent contributions and views, notably to the D'Herelle phenomenon (E. S. R., 48, p. 675).

"Evidence seems to indicate that we have here a group of viruses which, apart from the cell, are as inactive as any colloidal particle lacking that correlated organization which is characteristic of cell life. Within the cell such a virus possesses unusual activity, obviously. So far as resistance to environmental conditions is concerned . . . there may be no great difference between a living cell and enzyme and many types of biocolloids, but, on the whole, the mosaic virus behaves as if it were a biocolloid, yet one endowed with the power of reproduction. . . .

"If one is compelled to admit the existence of an organism of the size relations . . . referred to, it would seem necessary with the data at hand to conceive of it as a flagellum-like creature with perhaps a temporary hook up of molecules or colloidal particles, conceivably with no true bordering membrane and no restricted endometabolism. The supposition that the organism might be of an extremely fluid nature would perhaps be equally unsatisfying.

"Taking into consideration all the facts, we can not avoid the impression, tentatively, that the causal agency in mosaic disease may be, in any particular case, a sometime product of the host cell; not a simple product such as an enzyme, but a particle of chromatin or of some structure with a definite heredity, a gene perhaps, that has, so to speak, revolted from the shackles of coordination, and being endowed with a capacity to reproduce itself, continues to produce disturbance and "stimulation" in its path, but its path is only the living cell."

**Oiled wrappers, oils, and waxes in the control of apple scald**, C. BROOKS, J. S. COOLEY, and D. F. FISHER (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 11, pp. 513-536).—A detailed account is given of investigations on the control of apple scald by the use of various oils, fats, and waxes, either on the apple wrappers or on the apples themselves. A popular account of this investigation has been previously noted (E. S. R., 50, p. 552).

As a result of 67 apple storage experiments carried out under commercial storage conditions, the authors found that apples packed in the usual unoled



wrappers had practically the same degree of scald as those that were unwrapped. Paraffin wrappers caused considerable reduction in the prevalence of scald, but they were inferior to oiled wrappers. Apples in oiled wrappers showed little if any delay in coloring and were entirely normal in taste and appearance. Wrappers carrying less than 15 per cent oil were found less efficient in scald control than those carrying 15 per cent or more of oil.

Seven different mineral oils were tested in the oiled wrappers, and all were efficient in scald control. Oils and mixtures of oils and waxes applied to the skin of the apple gave erratic results, the efficiency of the treatment usually varying with the amount of oil applied.

The authors conclude that the checking of the changes from green to yellow in the skin of the apple is due to the oil actually deposited upon the apple, and that the extent of the scald control is largely determined by the amount of oil in close proximity to the skin of the apple but not necessarily deposited upon it.

**A bud rot of the peach caused by a species of *Fusarium*,** J. W. ROBERTS (*Jour. Agr. Research* [U. S.], 26 (1923), No. 10, pp. 507-512, pl. 1, fig. 1).—The author reports the isolation from dead peach buds from Georgia of a species of *Fusarium* that is considered probably identical with *F. gemmiperda*. Under conditions of extreme moisture the fungus was found to cause a bud rot of the peach, sweet cherry, and sour cherry. A description of the fungus and its reaction to culture media are given.

**Fruit-rotting *Sclerotinias*.**—I, Apothecia of the brown rot fungus, J. B. S. NORTON, W. N. EZEKIEL, and R. A. JEHLE (*Maryland Sta. Bul.* 256 (1923), pp. 3-32, figs. 18).—The results are given of a study of the apothecia of the brown rot fungus, *Sclerotinia cinerea*.

The development of the apothecial stage of the *Sclerotinia* causing brown rot of stone fruits in Maryland is described and illustrated, and results are given of observations and investigations on this stage.

The apothecia are said to mature at the time peaches bloom, after a slow development for more than a month. Abundant moisture is considered indispensable for the growth, and the apothecial development is retarded at low temperatures and hastened at higher ones. Burying sclerotia in the soil prevents the growth of apothecia, but when such buried mummies are brought to the surface they are able to produce apothecia the following spring. It was found that apothecia may be produced under normal conditions the spring after the fruit rots, but frequently they do not develop until the second spring.

The toxic effects of sulphur, lime-sulphur solution, copper-sulphate solutions, and corrosive sublimate were tested. Corrosive sublimate was the most toxic, and sulphur the least, due to the sulphur stimulating growth at a pH value of 3.4. Lime applied on the surface of pots in which mummies were planted prevented the growth of apothecia at a pH value of 6.65. It is suggested that the application of lime to the soil may prove a valuable auxiliary control measure against brown rot.

**Brown rot and related diseases of stone fruits in Oregon,** H. P. BARSS (*Oregon Sta. Circ.* 53 (1923), pp. 18, figs. 10).—A description is given of the brown rot of stone fruits due to *Sclerotinia cinerea*, and suggestions are given for its control. In connection with brown rot the author describes a false brown rot or internal browning which usually starts around the pit and often extends outward until in some cases it reaches the skin and involves the whole flesh. Related to the true brown rot is another which often severely attacks blossoms and spurs, producing blossom and spur blight and twig cankers on all kinds of stone fruits and on some varieties of pears. This disease is said to



be due to an undescribed species of fungus to which the name *Monilia oregonensis* n. sp. is given.

Detailed descriptions are presented of blossom and spur blight, twig cankers, etc. For control the author recommends winter pruning to remove all mummied fruits and dead spurs, early cultivation to cover the mummies as quickly as possible, spraying, and proper orchard sanitation.

**The red stain in the wood of box elder**, E. E. HUBERT (*Jour. Agr. Research* [U. S.], 26 (1923), No. 10, pp. 447-458, pls. 3, figs. 2).—The author describes a bright red stain of the wood of box elder which he has had under investigation since 1920. The cause of the discoloration is said to be the presence of a soluble red pigment produced by the mycelium of a species of *Fusarium*. The fungus is considered to be a weak parasite which develops in the wood through wounds. The value of the wood is greatly depreciated by the presence of the stain.

The distribution of the red stain disease is believed to coincide with the range of the box elder in the United States, and what is considered the same disease has been reported in several localities in Europe.

As a means of preventing the discoloration of the wood, sanitary measures directed to the proper care of wounds are suggested for shade trees. For forest trees the burning of all affected slash and the rapid handling of infected logs are believed to be of value.

The fungus causing the disease (*F. negundi* n. sp.) is technically described by C. D. Sherbakoff.

**White pine blister rust in western Europe**, W. S. MOIR (*U. S. Dept. Agr. Bul.* 1186 (1924), pp. 32, pls. 4, figs. 15).—An account is given of an investigation of a blister rust situation in Europe. The white pine blister rust is said to have been known for about 65 years on pine and currants in the Baltic Provinces of Russia. Later it was reported to seriously attack white pine trees in Finland. Subsequent surveys have shown the disease quite widely spread throughout western Europe. The conclusion is drawn that blister rust is gradually driving white pine out of Europe. In some of the plantations inspected more than 90 per cent of the trees were found to be infected, and frequently one-third of them were killed by the blister rust. The situation for planting white pine is considered very unfavorable in Denmark, Belgium, Norway, Germany, and elsewhere.

**Hot water treatment for nematode control**, H. H. ZIMMERLEY and H. SPENCER (*Virginia Truck Sta. Bul.* 43 (1923), pp. 267-278, figs. 6).—The results are given of 10 years' experiments to determine a satisfactory method for the control of nematodes (*Heterodera radiculicola*) in greenhouses and coldframes where steam is not available. The authors claim that midsummer applications of boiling water at the rate of 5 gal. per cubic foot of soil gave satisfactory control in both greenhouses and coldframes. Where hot water boilers of considerable capacity are available, this method of soil sterilization is considered practicable for commercial application.

Under very favorable conditions formaldehyde, calcium cyanamid, sodium cyanid, and carbon disulphid, although used in large amounts, were ineffective against nematodes.

## ECONOMIC ZOOLOGY—ENTOMOLOGY.

**Birds of the Pacific coast**, W. A. ELIOT (*New York and London: G. P. Putnam's Sons*, 1923, pp. XVII+211, pls. 56).—This pocket field book gives the distribution and habitat of 118 birds that are more or less common to the Pacific

Coast States and British Columbia, and only a few that are rare or of local occurrence. Many of the birds described may be found as far east as the Rocky Mountains, and some as far as the Mississippi Valley. The birds are illustrated in colors by R. B. Horsfall.

**Annual report of the State entomologist for 1921**, W. V. REED (*Ga. State Bd. Ent. Bul.* 63 (1922), pp. 11).—This is a brief statement of the status and progress of work in Georgia.

[**Orchard pests in Washington State**] (*Wash. State Hort. Assoc. Proc.*, 18 (1922), pp. 5-7, 12-52, 77-87; 19 (1923), pp. 12-18, 30-32, 34-50, 56-58, 60, 123-126).—The report of the proceedings of the annual and summer meetings of the Washington State Horticultural Association in 1922 includes the following papers relating to orchard pests of economic importance or control measures: Relation of Growth of Apples to Cover Sprays, by W. D. Whitcomb (pp. 5-7); The Drift and Development of Spray Practices in America, by L. Childs (pp. 12-21); Arsenate of Lead and the Leaf Roller, by H. E. Newman (pp. 21-35); Appearance, Habits, and Seasonal History of the Codling Moth, by W. D. Whitcomb (pp. 35-39); Codling Moth Control in Washington, by E. J. Newcomer (pp. 39-47); Codling Moth Control, by C. P. Wickersham (pp. 47-52); Red Spiders (pp. 77-79); and Conclusions Drawn from Spraying Experiences on San José Scale (pp. 79-83), both by A. L. Melander; and A New Oil Spray for the San José Scale, by E. J. Newcomer (pp. 83-87).

The corresponding papers for the 1923 meeting include the following: Nicotin Dust, by A. L. Lovett (pp. 12-18); Orchard Rodent Control, by L. Couch (pp. 30-32); Fruit Tree Leaf Roller, by J. B. Wiley (pp. 34-37); Progress Report on Red Spider Control, by M. A. Yothers (pp. 37-42); The Cherry Fruit Fly, by A. Frank (pp. 42-45); How Shall We Spray Next Year? by A. L. Melander (pp. 45-50); Lubricating Oil Emulsion, by E. J. Newcomer (pp. 56-58, 60); and Stationary Spray Systems, by F. C. Nielsen (pp. 123-126).

**Proceedings of the Acadian Entomological Society for 1922** (*Acadian Ent. Soc. Proc.*, No. 8 (1922), pp. 182, figs. 187).—This annual report of the proceedings of the Acadian Entomological Society (E. S. R., 49, p. 50) presents papers on The Use of Aluminum Sulphate in Place of Copper Sulphate in Insecticide-Fungicide Combinations, by A. Kelsall (pp. 8-17); Insect Pests of the Year 1922 in New Brunswick, by R. P. Gorham (pp. 18-22); The Morphology and Synonymy of *Psyllia mali* Sch., by W. H. Brittain (pp. 23-51); Some Notes on the Natural Control of the Pine Bark Aphid (*Chermes pinicorticis* Fitch) in New Brunswick, 1922, by A. H. MacAndrews (pp. 52-56); Papers on the Leafhoppers (Cicadellidae) of Nova Scotia.—I, External Morphology, by W. H. Brittain (pp. 57-72); A Histological Account of Three Parasites of the Fall Webworm (*Hyphantria cunea* Drury), by A. G. Dustan (pp. 73-95); Sulphur Dust as an Insecticide, by A. Kelsall (pp. 96-101); Records of Nova Scotian Hemiptera-Heteroptera, by H. M. Parshley (pp. 102-108); The Natural Control of the White Marked Tussock Moth Under City and Forest Conditions, by A. G. Dustan (pp. 109-127); Papers on the Leafhoppers of Nova Scotia, II, by W. H. Brittain and W. E. Whitehead (pp. 128-152); The Abdomen and Genitalia of *Philaenus lineatus* L., by G. E. R. Hervey (pp. 153-157); Some Notes on the Natural Control of the Larch Sawfly and Larch Case Bearer in New Brunswick in 1922, by A. B. Baird (pp. 158-171); and Notes on the Outbreaks of Spruce Budworm, Forest Tent Caterpillar, and Larch Sawfly in New Brunswick, by J. D. Tothill (pp. 172-182).

**Entomology as an aid to forestry**, C. S. JUDD (*Jour. Forestry*, 21 (1923), No. 8, pp. 788-793).—In this discussion the author calls attention to the relation of certain insects to forestry and the work of the entomologist with them.



**Forest entomological problems in the Lake States**, S. A. GRAHAM (*Jour. Forestry*, 22 (1924), No. 1, pp. 24-28).—This is a contribution from the Minnesota Experiment Station.

**Insects injurious to ornamental greenhouse plants**, C. A. WEIGEL and E. R. SASSCER (*U. S. Dept. Agr., Farmers' Bul.* 1362 [1923], pp. 11+81, figs. 91).—This is a practical summary of information on the important insect enemies of ornamental greenhouse plants and means for their control.

**[Animal pests and means for their control]**, W. T. HORNE, E. O. ESSIG, and W. B. HERMS (*California Sta. Circ.* 265 (1923), pp. 60-104).—Continuing the account noted on page 838, household insects and the animal parasites of cattle, sheep, dogs, swine, and rodents, first dealt with, are followed by a brief account of venomous insects, spiders, etc. Formulas and descriptions of material used in control work (insecticides, fungicides, etc.) are then presented (pp. 70-96). An index to the entire circular is appended (pp. 97-104).

**Retarded establishment of introduced parasites of injurious insects**, L. O. HOWARD (*Natl. Acad. Sci. Proc.*, 10 (1924), No. 1, pp. 16-18).—The author refers briefly to instances in which there was a retarded establishment of introduced parasites.

**Plant lice and light exposure**, S. MARCOVITCH (*Science*, 58 (1923), No. 1513, pp. 537, 538).—This is a contribution from the Tennessee Experiment Station, in which the author reports having found that it is the relative length of day to which the plant lice are exposed that appears to stimulate or retard the production of the sexes.

"Having been successful in the production of the sexes by the employment of a short day, and since the fall migrants or sexuparae of various plant lice are the antecedents of the oviparous forms, it was thought possible that the migration of plant lice is also due to the relative length of daily light exposure. And such was found to be the case with several species. Males and sexuparae of *Aphis rumicis* L., *Capitophorus hippophaes* Koch, and *A. sorbi*, Kalt, were produced experimentally in June, when the temperature is high, by keeping curled dock (*Rumex crispis*), smartweed (*Polygonum* sp.), and plantain (*Plantago lanceolata*), the respective summer hosts of the above species, exposed to a short day for about seven weeks."

**The resistance of apple stocks to attacks of the green apple aphid (*Aphis pomi* DeG.)**, A. M. MASSEE (*Jour. Pomol. and Hort. Sci.*, 3 (1924), No. 4, pp. 191-200, pls. 2).—This is a report of a study made of the resistance of varieties of Paradise stocks to the apple aphid.

**Hornworm septicemia**, G. F. WHITE (*Jour. Agr. Research* [U. S.], 26 (1923), No. 10, pp. 477-486, pl. 1, figs. 2).—This is a report of investigations of a disease of *Protoparce sexta* Johan. and *P. quinquemaculata* Haw. caused by a bacterium which enters the blood stream and multiplies rapidly, causing a septicemia, for which the author suggests the name hornworm septicemia. The author has isolated and cultivated an organism to which the name *Bacillus sphingidis* n. sp. is given. In the worms inoculated by puncture the disease runs a course of from 18 hours to 2 of 3 days, in which the most prominent symptoms are loss of appetite, stupor, diarrhea, and a thin vomitus. The more important post-mortem changes are a softening and blackening of the remains, which on drying become shriveled. This new organism is a short, actively motile, nonsporulating bacillus, readily destroyed by heat, drying, direct sunlight, and chemical disinfectants, but it lives a long period in a moist environment at room temperature.

"A comparatively small percentage of healthy worms die following inoculation with the virus of the disease by the feeding method, but practically 100 per cent of them succumb following puncture inoculations. Cutworms, catalpa



moth larvae, and grasshoppers are very susceptible to puncture inoculations with *B. sphingidis* and die speedily from septicemia. Indeed no insect species thus inoculated has been found immune. No appreciable loss of virulence has been noted in cultures of this bacillus kept four years on artificial media.

"*B. sphingidis* is similar in many respects to *B. (Coccobacillus) acridiorum*, the cause of the grasshopper disease discussed by d'Herelle [E. S. R., 26 p. 246]. They show, however, a distinct serological difference.

"The transmission of the disease in nature probably takes place as a rule by way of the alimentary tract, the portal of entry of the germ not being definitely known. The diagnosis of hornworm septicemia is suggested by the symptoms and post-mortem appearances and can be made positive by the isolation of *B. sphingidis* from the sick larvae or from the remains of those recently dead. Apparently comparatively few hornworms die of the disease in nature during the more active growing season of the crops on which these worms feed. Preventive methods are recommended to students of hornworms who may desire a treatment for this disease."

**Cutworm septicemia**, G. F. WHITE (*Jour. Agr. Research* [U. S.], 26 (1923), No. 10, pp. 487-496, pls. 2, figs. 2).—This is an account of investigations of a disease of the larvae of numerous species of Noctuidae caused by a new organism, to which the author gives the name *Bacillus noctuarum* n. sp. The name cutworm septicemia is suggested by the author for this affection.

The infection produced by puncture inoculation runs a course of from two to four days, the period depending very much upon the temperature. The most prominent symptoms of the experimentally produced disease are a lessened appetite and finally its failure, listlessness, a lack of turgidity of the body, a diarrhea, a thin discharge from the mouth, and death. The bacterial species occurring in the septicemia is demonstrated to be a short, actively motile bacillus.

*B. noctuarum* remains alive for a long period in a moist environment at ordinary temperature, but is readily destroyed by heat and by drying, being quite susceptible to direct sunlight and to chemical disinfectants. The septicemia is not readily produced by feeding but is readily produced by puncture inoculations, the mortality then being approximately 100 per cent. Hornworms, silkworms, catalpa moth larvae, and grasshoppers are also susceptible to inoculation with *B. noctuarum* when the puncture method is employed. The change, if any, in the virulence of a culture of this bacillus after four years on artificial media has been slight. *B. noctuarum* is similar in many respects to *B. (Coccobacillus) acridiorum* and to *B. sphingidis*. Serologically they are distinctly different.

"Probably the disease is transmitted in nature most often by way of the alimentary canal. Cutworm septicemia may be suspected from the symptoms and post-mortem changes. The diagnosis is definitely made by finding *B. noctuarum* present in large numbers. Apparently a comparatively small percentage of cutworms die of this disease in the field during the more active growing season of the crops on which they feed. Preventive treatment is suggested to those making studies on cutworms and wishing to reduce the loss of insects due to this infection."

**Corn insects**, J. FEYTAUD (*Rev. Zool. Agr. et Appl.*, 22 (1923), No. 8, pp. 218-223, fig. 1).—In this paper the author deals with the cornstalk boring noctuid *Sesamia nonagrioides* Lef.

**The distribution of the pale western cutworm, *Porosagrotis orthogonia* Morr.:** A study in physical ecology, W. C. COOK (*Ecology*, 5 (1924), No. 1, pp. 60-69, figs. 7).—This is a contribution from the Montana Experiment Station.



"An attempt is made to evolve by statistical methods a curve and climograph showing the sum total effect of climate upon the life history of the pale western cutworm (*P. orthogonia*). By combining the monthly figures for temperature and precipitation in the areas of greatest abundance during the generation preceding the June in which damage was reported, and weighting them with the reported percentage of total seeded area destroyed, mean figures were obtained for each month of the preceding year, from which the climograph was plotted and the curve calculated. Assuming this curve to represent the optimum conditions for the species, the climographs for normal conditions at practically all of the Great Plains and Great Basin stations were compared therewith and divided into groups according to the closeness of their resemblance to the optimum curve. These groups were then charted on a map and lines drawn to indicate climatic conditions very favorable to this species, less favorable, and absolutely unfavorable. If the assumption is correct, this map should show the final range of this species, outside of which it will probably never be found in destructive numbers."

**The eggplant leaf-miner, *Phthorimaea glochinella* Zel.,** T. H. JONES (*Jour. Agr. Research* [U. S.], 26 (1923), No. 11, pp. 567-570, pl. 1).—The eggplant leaf-miner has been recorded in literature as feeding only on the leaves of the weed *Solanum carolinense*. It has, however, been reared on tomato leaves from Spreckels and Brawley, Calif., and from Los Mochis, Sinaloa, Mexico, and has been found by the author to be a common, though not serious enemy of eggplant in Louisiana. In addition to the above-mentioned localities, the species has been recorded from Virginia, Kentucky, Missouri, Texas, and Colorado. Technical descriptions are given of its several stages, and a brief reference is made to its habits and natural enemies.

At Baton Rouge the incubation period of the egg in June was about 7 days. The larvæ, which issued June 21, reached maturity and emerged as moths on July 15. The larvæ have been taken from the leaves in the field from early May to the middle of November, and there may be several broods during the year, the winter months apparently being passed in the pupal stage.

Six species of hymenopterous parasites have been reared from the larvae, namely, *Chelonus phthorimaeae* Gah., *Orgilus mellipes* Say, *Bassus gibbosus* Say, *Sympiesomorphelleus bicoloriceps* Gir., *Bassus* sp., and *Apanteles* sp.

**Preferential feeding experiments with anopheline mosquitoes, II,** C. G. BULL and B. D. REYNOLDS (*Amer. Jour. Hyg.*, 4 (1924), No. 2, pp. 109-118, fig. 1).—In this continuation of studies previously noted (E. S. R., 50, p. 259), the authors have shown that man can not be wholly protected from the bite of a certain strain of *Anopheles quadrimaculatus* by the immediate presence of domestic animals, but that the number of bites a man would receive in the absence of the animals may be greatly reduced.

"The relative attractiveness of various species of domestic animals for the mosquitoes was determined and is presented in graphic form. In comparing the horse and cow, it was found that the individual was of greater significance than the species. It was also found that the mosquitoes show decided preference among individuals of the human race. The mosquitoes would scarcely feed on chickens and rabbits even in the absence of other animals. In localities where malaria is just maintaining itself, it would be quite possible to break the life cycle of the plasmodia by increasing the number of domestic animals, particularly horses, cows, and dogs. These animals should, of course, be kept in close proximity to the human domiciles, especially at night."

**The effect of oil upon *Anopheles* mosquito larvae,** H. W. GREEN (*Amer. Jour. Hyg.*, 4 (1924), No. 1, pp. 12-22).—The author finds that the oil film causes full-grown *Anopheles* larvae to die (1) by suffocation due to a mechanical bar-



rier being formed, preventing them from reaching the outside air, (2) by suffocation due to the oil entering their breathing siphons to an extent sufficient to physically block the passage of air, and (3) by poisoning due to the toxic properties of the volatile portions of the oil penetrating the tracheal tissues. The rapidity with which the larvae die is dependent upon the volatility and toxicity of the oil. The larvae obtain their fatal dose in a very short time, although the exact minimum time has not been determined. Increasing the length of the exposure to the oil beyond a few seconds, i. e., a sufficient time to get the fatal dose, does not seem to decrease the length of the life of the larvae. *Culex* larvae require a much longer time to die than *Anopheles* larvae.

**A revision of the North American two-winged flies of the family Therevidae**, F. R. COLE (*U. S. Natl. Mus. Proc.*, 61 (1923), Art. 4, pp. 140, pls. 13, figs. 3).—In this revision the author erects four genera and describes numerous forms as new to science.

**Observations on some "biological species" among the Tachinidae**, W. R. THOMPSON (*Bul. Soc. Zool. France*, 48 (1923), No. 4-5, pp. 165-170).—This is a discussion of certain tachinid parasites which are morphologically similar, but which are distinguishable through their host relations.

**The larch longicorn beetle (*Tetropium gabrieli* Weise.)** ([*Gt. Brit.*] *Forestry Comm. Leaflet* 13 (1923), pp. 5, figs. 3).—This is a brief summarized account of *T. gabrieli*.

**Control of the cane grub**, E. JARVIS (*Facts About Sugar*, 17 (1923), No. 10, pp. 230, 231).—This is a report of the entomologist of the Bureau of Sugar Experiment Stations, Queensland, in which it is pointed out that at least 15 methods of combating the grayback beetle during its grub stage are recognized. The author considers the use of soil fumigants to stand first and foremost as offering the best chance of successfully dealing with the grub stage of the grayback cockchafer.

**Distribution of *Epilachna corrupta* Muls.**, F. H. CHITTENDEN (*Bul. Brooklyn Ent. Soc.*, 19 (1924), No. 1, p. 3).—A brief account of the occurrence and spread of the Mexican bean beetle.

**The raspberry fruit worm, *Byturus unicolor* Say**, B. H. WALDEN (*Connecticut State Sta. Bul.* 251 (1923), pp. 89-99, pls. 4, fig. 1).—This insect, though long known as an enemy of red raspberries in the United States, has been studied but little. It is said to have been on the increase in Connecticut since the St. Regis everbearing raspberries came into general cultivation, and in the present paper the author reports upon observations at East Haven during the years 1921 to 1923. The pest was originally described by T. Say in 1823 from Arkansas, and it appears to have a wide distribution in the United States and southern Canada.

In Connecticut the larva has been found attacking the fruit of only the red species of raspberries and shows a decided preference for certain horticultural varieties. The work of the adults, however, has been observed on the foliage of blackcap raspberries and the Columbian or purple raspberry. There are two records of the infestation by this insect of the fruit of the blackberry. There are three distinct types of injury caused by it: (1) The feeding of the adults on the unfolding leaves, often skeletonizing them, (2) the damage to blossom buds by the beetles, which eat out the inside and when numerous may destroy the whole bud cluster, and (3) the infestation of the fruit by the larvae, which often develop in and destroy the fleshy receptacle, causing the fruit to dry up before ripening, or they may feed on the carpels which dry up or become infected with a mold, which causes the remainder of the berry to decay or become soft.



"In the East Haven field in 1921, a count of the fruit buds in the most severely infested portion of the field showed that about 37 per cent of the buds had been injured by the beetles, and at the time the fruit was ripening 57.9 per cent of the berries that developed were infested with the larvae. The owner did not harvest the early fruit of this variety either in 1921 or 1922."

The beetles appear in spring soon after the new growth of the plants is well started, having been abundant on May 10 in 1921 and from May 12 to 16 in 1922. The first eggs were found on May 10 in 1921 and on May 22 in 1922, 14 days after the first adults were observed. They are deposited singly and are quite difficult to find in the field. Newly hatched larvae were found in the field on May 27, 5 days after the eggs were first observed. Full grown larvae were found on June 16, and a few berries containing larvae were gathered as late as July 18. After leaving the berries the larvae drop to the ground and enter the soil, forming small circular cavities or pupal cells about 3 mm. in diameter. In an examination of the soil on October 26 the pupae were found to have transformed to adults. Technical descriptions are given of the several stages.

Control work during the two years has shown the pest to be a difficult one to combat. The foliage should be kept well coated with lead arsenate from the time that the first beetles appear until the blossom buds open to such an extent that there is danger of poisoning bees.

"If the fruit is infested with the worms to such an extent that it is unsalable, the second year's infestation can be greatly reduced by removing and burning the entire fruit clusters at about the time the earliest fruit begins to ripen. Observations during the past two seasons indicate that the eggs have practically all been laid at this time, and that but few, if any, of the larvae have left the fruit to go into the ground. Thorough, shallow cultivation as close as possible to the plants from late summer to early fall will tend to break up the pupal cases and expose the pupae to the elements. The pupae are fragile, and in the laboratory cages were readily killed by stirring the soil, and quickly dried up when exposed on the surface. In the field the larvae and pupae have only been observed in the upper 0.75 in. of the soil."

**The Mexican bean beetle, a new and serious pest in Tennessee, G. M. BENTLEY** (*Tenn. Dept. Agr. Bien. Rpt., 1921-22, pp. 85-90, figs. 2*).—The author records the occurrence of heavy infestations of *Epilachna corrupta* Muls. in Tennessee in 1921 at Signal and Lookout Mountains and in many sections of the highland rim in the Cumberland Mountains. The amount of the infestation is said to indicate that some had been present at least a year previous.

**Lema trilineata** Ol. (Coleop.) controlled by an egg parasite, F. H. CHITTENDEN (*Ent. Soc. Wash. Proc., 26 (1924), No. 2, pp. 46-48*).—The author records the parasitism of *L. trilineata*, which develops normally on *Datura* and feeds freely on certain other Solanaceae, such as *Solanum* and *Physalis*, by the chalcid *Emersonella lemae* Gir.

**Biology of the false wireworm Eleodes suturalis Say, J. S. WADE and R. A. ST. GEORGE** (*Jour. Agr. Research [U. S.], 26 (1923), No. 11, pp. 547-566, pls. 2, figs. 4*).—This is a report upon studies of a tenebrionid which has become a serious menace to the production of wheat and other small grains in both irrigated and nonirrigated districts in some of the semiarid regions of the Middle West. The principal damage is caused in the fall by the larvae feeding upon the recently sown wheat grain and its sprouts, thus retarding or preventing the formation and growth of the young plant. It also injures or destroys growing wheat in the spring. The authors deal with the life history and habits of the pest, based upon studies made in the years from 1914 to 1917 in the latitude of southern Kansas, its distribution, food plants, nature



of the injury, natural enemies, and control measures. Technical descriptions are given of its several stages.

The egg is deposited in soft, loose soil at a depth of from 0.75 to 1 in., from 10 to 60 being found in a single nest. The larvae hatch out in from 8 to 10 days, and soon begin to feed very actively upon vegetable tissue and roots in the soil. Under favorable weather conditions and with adequate food supply, they grow rapidly, reach maturity, and enter the pupal stage in from 110 to 130 days. The pupal stage lasts for a period varying from 10 to 22 days, during which time the insect is comparatively motionless in an earthen cell at a depth of about 3 in. in the soil.

A bacterial disease which spreads from diseased to healthy larvae with which they come in contact was observed by the authors. The larva was observed to be attacked by fungi, and mention is made of a number of predatory enemies. The parasite *Perilitus eleodis* was reared from the beetles, as many as 121 having been obtained from a single host individual.

"The easiest and most effective control measure thus far indicated is the judicious rotation of wheat with other crops for two or more seasons, especially with corn or some other crop which may be regularly and frequently cultivated. Infestations are always much heavier where rotation has not been practiced. It is also highly desirable that all accumulations of rubbish, dead grass, matted weeds, old straw stacks, old discarded bundles of mixed weeds and grass, and other shelter and hibernating quarters be burned or entirely removed."

A list is given of 38 references to the literature cited.

A staphylinid parasite of fucicole muscids, *Aleochara (Polystoma) algarum* Fauv., and the adaptation of the larva to a parasitic life, P. LESNE and L. MERCIER (*Ann. Soc. Ent. France*, 91 (1922), No. 4, pp. 351-358, fig. 1).—This account of the life history, habits, and anatomy of *A. algarum* includes a review of the literature in connection with a list of 13 references.

Notes on the biology of the four-spotted bean weevil, *Bruchus quadrimaculatus* Fab., A. O. LARSON and P. SIMMONS (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 12, pp. 609-616, fig. 1).—This is a report of observations of *B. quadrimaculatus*, presented in large part in tabular form.

"The results of this study indicate that the average lengths of the developmental periods of larvae of *B. quadrimaculatus* which hatch from eggs laid on successive days in the fall tend to be inversely proportional to the duration of the exposure of the embryos and young larvae to warm weather. The age of a female weevil at the time of laying a given day's batch of eggs influences (1) the number of eggs in the batch and (2) the vitality of the eggs, as indicated by the percentage of hatching, the ability of the resultant larvae to become adults, and the average duration of the developmental periods of the progeny."

The boll weevil problem in Arkansas, D. ISLEY and W. J. BAERG (*Arkansas Sta. Bul.* 190 (1924), pp. 3-39, figs. 8).—This is a discussion of the boll weevil, its life history, seasonal history, and habits in Arkansas and means for its control. Experiments were conducted in five counties, representing as nearly as possible the different cotton regions in Arkansas in which the dust calcium arsenate, sweetened poison, and Florida methods of control were compared. The results obtained have led to the recommendation that "in situations where weevils can not be destroyed in hibernation and where early infestations of cotton fields occur, dusting with calcium arsenate should be depended on as a means of control. Dust applications should begin when the weevils have punctured 10 to 15 per cent of the squares. Dust should be applied at the rate of 5 to 7 lbs. to each acre. A series of three or four applications applied



at intervals of four or five days will usually bring the weevils under control. If the infestation again becomes serious enough to check fruiting, more applications may be desirable."

**Rynchophora injurious to cabbage**, J. C. FAURE (*Rev. Zool. Agr. et Appl.*, 22 (1923), Nos. 2, pp. 35-43, figs. 5; 3, pp. 84-93, fig. 1).—This is an account of *Baris chlorizans* (Germ.) and *B. cuprirostris* (Fab.), the larvae of which attack the roots and stalks of cabbage in France. This account is based upon a study of their life history and habits, natural enemies, and means of control conducted by the author in 1922. A list is given of 25 references to the literature.

**Arsenic, calcium arsenate, and the boll weevil**, H. W. AMBRUSTER (*New York: Barr-Erhardt Press, Inc.*, 1923, pp. VI+42, figs. 2).—This is a compilation of the articles and addresses of the author on the calcium arsenate and arsenic situation as related to boll weevil control.

**Another seed chalcid attacking the cultivated grape**, A. B. GAHAN (*Ent. Soc. Wash. Proc.*, 26 (1924), No. 2, p. 48).—The author records observations which show that *Prodecatoma phytophaga* develops in the seeds of the cultivated grape.

**The dermanyssid mites of North America**, H. E. EWING (*U. S. Natl. Mus. Proc.*, 62 (1923), Art. 13, pp. 26, pls. 2, figs. 7).—In this paper the author erects 6 genera and describes 11 species as new to science.

**The European red mite in Connecticut apple orchards (*Paratetranychus pilosus* C. & F.)**, P. GARMAN (*Connecticut State Sta. Bul.* 252 (1923), pp. 101-125, pls. 4, figs. 4).—This is a report of studies of the life history and habits, natural enemies, means of control, etc., of this pest, much of the data relating to which is presented in tabular form. Earlier studies of this pest by the author (*E. S. R.*, 45, p. 149; 46, p. 753; 47, p. 155; 50, p. 50) and by other observers have been noted.

"The European red mite passes the winter in the egg stage upon smaller twigs and branches. Eggs hatch in April or May at the time fruit buds are turning pink. The incubation period of the summer egg varies from 6 to 13 days, and the adult develops in 5 to 10 days. The preoviposition period lasts from 1 to 7 days, but eggs are usually laid within a few days after emergence. Adults lived 6 to 19 days, and adult females laid a total of 16 to 34 eggs during their lives. Winter eggs are sometimes laid in August, usually, however, during September and early October. Winter eggs are dark red, summer eggs, brown. This mite is easily distinguished from other species in adult and egg stage. An infestation of 50 to 100 mites per leaf is sufficient to cause leaves of apple trees to turn brown. Baldwin is the variety most commonly injured.

"Enemies become numerous in July and August, and are often responsible for the disappearance of the red mite. Dry weather in summer favors their development, and a wet period with frequent showers keeps them in check. A definite spray schedule should be adopted in orchards where mites are numerous. Lime sulphur delayed dormant spray is not effective because of the late hatching of the egg. Miscible oils are effective dormant sprays, and with care are reasonably safe in orchard work. Fall sprays of miscible oil are apparently ineffective. Lime sulphur, summer strength, sprays should be applied early, beginning with the pink spray, which should be followed by at least two others containing lime sulphur, the latest being applied the last of June or first of July. Nicotin sulphate is unnecessary in the spray mixture so far as mite control is concerned. Soaps, miscible oils, and linseed oil emulsion are very effective summer sprays, but needless and apparently less efficient in control of fungus diseases than lime sulphur."

A list is given of 18 references to the literature.



## FOODS—HUMAN NUTRITION.

**Nutrition: The chemistry of life**, L. B. MENDEL (*New Haven: Yale Univ. Press; London: Humphrey Milford, Oxford Univ. Press, 1923, pp. XII+150, pls. 3, figs. 68*).—The science of nutrition—a retrospect, the importance of "little things" in nutrition, the vitamins, the protein factor in nutrition, and the energy problem in nutrition are the subjects of the five chapters making up this volume and which were originally given as a series of lectures at the University of California, under the title of Viewpoints in the Study of Nutrition. The introductory chapter traces, largely through excerpts from authoritative sources, the gradual development of our modern conception of nutritive requirements. This chapter is illustrated by reproductions of photographs of Beaumont, celebrated through his physiological studies conducted on Alexis St. Martin; Magendie, the French physiologist who demonstrated the unlike nutritive value of proteins, fats, and carbohydrates; Mulder, the Dutch physiological chemist who coined the name protein; Liebig, who emphasized the significance of proteins; and Voit, who developed the idea of the dual function of food in replacing and preventing loss.

The remaining chapters discuss briefly some of the more recent contributions to the science of nutrition along the lines indicated in the chapter headings, and are abundantly illustrated by photographs and charts from the original publications.

**The relative values of fats** (*Jour. Amer. Med. Assoc., 81 (1923), No. 22, pp. 1881, 1882*).—This editorial discussion is based to a considerable extent on investigations on the digestibility of fats carried on in connection with the home economics work of the U. S. Department of Agriculture.

**Some factors which influence the feathering of cream in coffee**, L. H. BURGWALD (*Jour. Agr. Research [U. S.], 26 (1923), No. 11, pp. 541-546*).—In determining the effect of various factors on the feathering or curdling of cream in coffee, the acidity of the coffee was taken as the basic factor to be kept uniform during the study of the other factors. An examination was first made of the acidity of coffee prepared by different processes and from different grades. The process and the grade of coffee were found to have no appreciable effect on the acidity, the H-ion concentration being in the neighborhood of pH 4.92 in all cases.

For the study of the other factors drip coffee prepared from a special commercial brand was used in every case, and the concentration and temperature of the coffee were kept uniform in the different tests. Cream of varying acidity was mixed with the coffee and sugar in various ways. It was found that adding the coffee to the cream and sugar had the greatest effect (feathering occurring at the lowest acidity) and to the cream without sugar the least effect on feathering. It is suggested that in the former case the sugar tends to dissolve in the moisture of the cream, causing the precipitation of some of the casein, which gives the effect of feathering.

Of the other factors tested, aging of the cream at low temperatures, with no increase in acidity, had no effect on feathering; pasteurization had a very slight effect, pasteurized cream feathering at a slightly lower acidity than unpasteurized; and freezing the cream had no effect on feathering, but a heavy oily layer always appeared on the coffee. Homogenization of the cream caused it to feather at a very much lower acidity than any of the nonhomogenized creams. This effect was more pronounced the greater the homogenizing pressure used.

**Studies on the working action of baking powders**, J. TILLMANS and A. GÜETTLER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 45 (1923), No. 2, pp. 102-112*).



figs. 8).—The efficiency of various types of baking powder was tested by noting the time required for the setting free of carbon dioxid from solutions of the powders at different temperatures and by comparing the quality of breads prepared with the different powders and baked under identical conditions.

As judged by both tests, the best baking powder was a mixture of potassium hydrogen tartrate and sodium bicarbonate. From this powder three-fourths of the carbon dioxid was set free in the cold in 5 minutes and the rest in 15 minutes more. Bread baked with this powder was also of the best quality. The samples which contained, in addition to sodium bicarbonate, tartaric acid, potassium disulphate, or aluminum sulphate were unsatisfactory through too rapid setting free of carbon dioxid. Among the samples from which carbon dioxid was liberated only on warming, a mixture of sodium bicarbonate and primary calcium phosphate gave good results. About two-thirds of the carbon dioxid was liberated at 60° C. in 25 minutes. The action of such a powder is consequently one-third weaker than a tartrate powder. Typical baking powders which gave off carbon dioxid at too high a temperature for satisfactory results were sodium bicarbonate alone, ammonium bicarbonate alone, sodium bicarbonate and ammonium chlorid, and sodium bicarbonate and secondary phosphate.

**The growth of yeasts on synthetic agar media,** E. I. FULMER and M. GRIMES (*Jour. Bact.*, 8 (1923), No. 6, pp. 585-588).—Three synthetic agar media have been compared with the ordinary whey agar and beer wort agar for the growth of yeast. All of the synthetic media contained ammonium chlorid 0.188, dipotassium phosphate 0.1, and agar 1.5 gm. per 100 cc. Medium I contained in addition 0.1 gm. of calcium chlorid and 5 gm. of cane sugar, Medium II 5 gm. of cane sugar, and Medium III 0.1 gm. of calcium chlorid. With Medium I as basal, the concentration of ammonium chlorid was varied from 0.062 to 0.248 gm. per 100 cc. The various media were tested by the growth of three types of yeast as determined after incubation for one week at 20° C., whey agar and wort agar being used for comparison.

No difference was noted in the number of colonies with varying concentrations of ammonium chlorid. The three types of yeast grew well on Media I and II but poorly on Medium III, and in no case was there a decrease in the number of colonies as compared with those produced on whey or wort agar.

It is concluded that synthetic agar media may be used for quantitative work with the three types of yeast studied, and are particularly suitable for the growth of yeast on account of furnishing poor conditions for the growth of bacteria.

**The use and abuse of weight-height-age tables as indexes of health and nutrition,** B. T. BALDWIN (*Jour. Amer. Med. Assoc.*, 82 (1924), No. 1, pp. 1-4).—This address, which was delivered before the International Health Congress at San Francisco, July 4, 1923, deals with errors which are often made in the measurements of height and weight for comparison with standard tables, the basic essentials of health examinations, the correlation of physicians' ratings with weight-height-age tables, the variability in growth for sex and age, and the source of material for, and a method of using, the Baldwin-Wood weight-height-age tables which are presented. The data presented in these tables have been selected from the measurements obtained by trained examiners with standard methods on a large number of children from 11 of the best schools in America. At least 95 per cent of the children were American born. The figures included only those of children presumably healthy and on whom from 5 to 14 consecutive measurements were taken, nearly all of these at yearly intervals.



In the use of these tables "a deviation of only a few pounds from normal weight is not considered significant, but children under 10 years who are 6 per cent or more underweight for their height and age, and those over 10 years who are 8 per cent or more underweight for their height and age, are likely to be in need of medical attention. Children who are 15 per cent overweight for their height and age may also be in need of medical attention."

**Do height and weight tables identify undernourished children?** L. I. DUBLIN and J. C. GEBHART (*Amer. Jour. Pub. Health*, 13 (1923), No. 11, pp. 920-927).—A comparison is reported of the extent of malnutrition as determined by physical examination records and by weight records of Italian children, including 1,878 boys and 2,160 girls, of the Mulberry district of New York City. The physical examination was made by a well-trained pediatrician, and the diagnosis of defective nutrition was based, in addition to weight and height, on such items as the state of musculature, luster of eyes, color and bearing, and relative amount of fat. As standards of malnutrition according to weight both 7 and 10 per cent below the average weight by the Wood-Woodbury tables were used. Tabulations are given of the number by age and sex of those classed as well- and undernourished and the percentage agreement of all cases.

Physical examination showed 34 per cent of all the children to be undernourished, the weight tables with 7 per cent limit 12.4 per cent, and with 10 per cent limit only 6.2 per cent. The group classed as well-nourished by the physical examination included 97.6 per cent of the boys and 94.5 per cent of the girls placed in the same group by the 7 per cent weight limit. The group representing defective nutrition, as judged by physical examination, contained only 22.8 per cent of the boys and 32.9 per cent of the girls according to the 7 per cent limit. The greatest discrepancies were shown among the youngest children.

These results show that standard tables have very little value in selecting undernourished Italian children. This is thought to be due partly to the fact that Italian children deviate widely from the national type, being from 1 to 7 per cent below the average figures of the Children's Bureau in weight and from 1 to 10 per cent in height. This was illustrated by a comparison of the actual weight of the children with a table of standards prepared from the average heights and weights of all the Italian children of this district. Using these standards, the percentage agreement with the physical diagnosis was for the boys 50.3 per cent using the 7 per cent limit and 38.2 per cent using the 10 per cent limit. Corresponding figures for the girls were 51 and 38.2 per cent, respectively.

**The influence of the H-ion concentration and buffer value of foods on digestion, with special reference to infancy,** H. K. FABER and F. HADDEN (*Med. Clin. No. Amer.*, 6 (1922), No. 2, pp. 245-261).—The authors discuss the normal digestive processes in adults and infants in terms of the H-ion concentration most favorable for the action of the digestive enzymes, and present data on the initial reaction and the degree of buffer resistance both to acids and alkalis of a number of foods such as are ordinarily used in infant feeding. The pH values determined electrometrically on some of the materials tested are as follows:

Colostrum, average pH of 5 samples 7.74; cow's milk, average of 50 samples 6.89; 1 part milk and 2 parts distilled water, 7.09; 2 parts milk and 1 part distilled water, 6.96; whey from milk of original pH value 6.97, 7; Fer-mil-lac, 4.55; *Bacillus acidophilus* milk of 12, 18, and 24 hours' incubation, 6.48, 6.02, and 5.52, respectively; protein milk made with Fer-mil-lac, 5.35; various carbohydrate foods, from 5.93 to 8.30; various milk and carbohydrate mixtures, from 6.83 to 7.25; and limewater U. S. P. 12.56.



In determining the buffer values, standards of pH 5 and pH 7.7 were used as representing the gastric acidity and the intestinal alkalinity of infants. The highest buffer values with respect to acidity were obtained with milk mixtures and the lowest with certain carbohydrate foods and protein milk. With respect to alkalinity, the highest buffer values were obtained with lactic acid milk. Colostrum, cow's milk of one-third dilution, and whey required about the same amount of acid to bring 100 cc. to pH 5.5.

In discussing the significance of these results, the following points are brought out: "The reaction and buffer properties of colostrum indicate that it is intended for intestinal digestion rather than for gastric. The development of gastric digestion is believed to be a gradual one, probably not completed for a considerable period under normal conditions.

"The reaction and buffer properties of protein milk and lactic acid milks suggest that their curative effect may be due to a stimulation of gastric function to take up a greater share of digestion.

"Most of the carbohydrate infant foods have little or no buffer value and hence do not materially affect the digestibility of milk. Those foods, however, to which potassium carbonate has been added are somewhat alkaline and interfere to some extent with gastric digestion."

**The effect of improved feeding on the physical and mental development of undernourished and backward children,** F. M. GRAPER and E. W. PARK (*Jour. Home Econ.*, 15 (1923), No. 11, pp. 627-632).—Eight children from 8 to 13 years of age, who were below normal weight (with one exception) and below normal mentality for their age, were given daily, five days a week for a period of ten weeks, a midday lunch which was planned to supply over one-half the total calories for the day, about one-half the daily protein requirement, from one-half to two-thirds of the fat, one-half of the carbohydrate, all of the calcium, three-quarters of the phosphorus, and over one-half of the iron. The meal consisted of a vegetable soup, usually prepared with milk, a scalloped or creamed vegetable dish, a pudding or stewed fruit, milk or cocoa to drink, and either white or brown bread with butter.

While the period was too short and the number of pupils too small to permit of definite conclusions being drawn, there was in all cases a gain in weight and in all but one case a gain in mental efficiency as shown by an increase in the intelligence quotient.

**An experiment in the nutritive value of an extra milk ration,** G. A. AUDEN (*Jour. Roy. Sanit. Inst.*, 44 (1923), No. 7, pp. 236-247).—A demonstration of the value of milk as a supplementary meal for both undernourished and supposedly adequately nourished children is afforded by the results obtained with 60 children in a school situated in a slum section of Birmingham, England. For the first two months of the experiment, 30 poorly nourished children (15 boys and 15 girls) received a pint of milk daily, except Sunday, in addition to their usual meals, while 30 normal or average children of the same age and sex served as controls. At the end of this period, the children in both groups received the milk for an additional period of two months. Measurements of height and weight were taken every two weeks and the percentage of hemoglobin in the blood was estimated with a von Fleischel's hemometer. A final examination was made of the children one month after the experiment had ceased.

Among the poorly nourished children, the first and most noticeable result of the extra ration was an improvement in bodily and mental vigor which was noted by both teachers and parents. This is thought to be associated with a rise in hemoglobin content of the blood, amounting to about 20 per cent and



manifesting itself before an increase in weight. The increase in weight of both boys and girls in the first period was considerably greater for those receiving milk than for the controls. In the second period, when both groups received milk, the gain in weight of the poorly nourished children was less than in the first period and considerably less than that of the normal children. The increase in hemoglobin was not so marked in the second period, but was greater in the poorly nourished than in the controls in both periods. In the month after the milk feeding had been stopped, there was a slight loss in percentage of hemoglobin in all groups except the control boys and a slight loss in weight in all cases. A diminution in the brightness and spirits of the children was also noted.

**Acidified whole milk as a routine infant food**, W. M. MARRIOTT and L. T. DAVIDSON (*Jour. Amer. Med. Assoc.*, 81 (1923), No. 24, pp. 2007-2009).—Directions are given for the home preparation of lactic acid milk for infant feeding, with formulas for different ages. It is stated that more than 1,000 infants in St. Louis have been fed on the formulas described, with results appreciably better than have been obtained in any other artificially-fed group.

**Effects of excess of calcium on the skeleton**, V. KORENCHEVSKY (*Brit. Med. Jour.*, No. 3254 (1923), pp. 802-804).—In attempts to answer the question as to whether the experimental rickets induced in rats by diets deficient in vitamin A and furnishing a sufficient but not excessive amount of calcium (E. S. R., 46, p. 568) belonged to the low calcium class of rickets, and the further question as to the possibility of increasing the calcium content of the skeleton of normal animals on normal diets, 7 feeding experiments were conducted on 39 rats belonging to seven litters. The technique of the previous experiments was followed, with the exception that in some of the normal and the A-deficient diets the amount of calcium was increased by the addition of calcium carbonate and the normal diets of some groups contained butter instead of cod liver oil as the sole source of vitamin A. The data obtained include the food consumption of the rats by litters and the percentage of calcium in the bones at the end of the experiment.

On the normal diets the animals receiving butter in place of cod liver oil showed no difference in the extent of calcification. Since this experiment was conducted in winter, it is concluded that butter even in winter may contain sufficient antirachitic vitamin. An increase to double and treble the amount of calcium in diets containing 8 per cent of butter and 2 per cent of cod liver oil did not increase to any appreciable extent the calcification of the skeleton, nor did it cure the rachitic decrease in calcium of the skeleton of rats on the diets deficient in vitamin A. It is concluded that the rachitic condition developing on diets deficient in vitamin A is the form of rickets which develops even with an excess of calcium in the diet.

**Progress in vitamin research**, C. FUNK and H. E. DUBIN (*Jour. Amer. Pharm. Assoc.*, 12 (1923), No. 12, pp. 1077-1080).—A brief summary of the present status of vitamin research.

**The present position of the vitamin problem, I, II**, F. G. HOPKINS (*Brit. Med. Jour.*, 1923, Nos. 3277, pp. 691-693, fig. 1; 3278, pp. 748-750).—The first of the two Cameron Prize lectures delivered at the University of Edinburgh on June 27 and 28, 1923, presents a concise summary of the present status of research as to the distribution, physical and chemical properties, and mode of action of vitamins A, B, and C. The second lecture deals specifically with rickets as a deficiency disease, with particular emphasis on the pioneer work of Mellanby on this subject.

**The vitamin content of various edible mushrooms**, S. HARA (*Biochem. Ztschr.*, 142 (1923), No. 1-2, pp. 79-100, figs. 19).—Various edible mushrooms



were tested for the presence of vitamins A, B, and C by appropriate feeding experiments with rats, mice, pigeons, and guinea pigs.

Since the experiments were conducted with the dried product, the negative results obtained for vitamin C can not be considered conclusive. Vitamin A was not present in appreciable amounts in any of the varieties tested, but all gave positive tests for vitamin B both with respect to growth-promoting and to antineuritic properties. The edible boletus, *Boletus edulis*, proved richest in vitamin B, doses of from 0.3 to 0.5 gm. of the dried material being sufficient to promote normal growth in rats on a vitamin B deficient diet. In decreasing order were *Psalliota arvensis*, *Cantharellus cibarius*, *Clitocybe mellea*, *Hydnum repandum*, and *Craterallus cornucopioides*, the last three having quite insignificant amounts of vitamin B.

**Contribution to the study of vitamins, especially in cow's milk, P. LAVIALLE** (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 33, pp. 1031-1035).—Three pigeons weighing from 225 to 250 gm. each were fed polished rice until they showed symptoms of polyneuritis and their weight had decreased to about 180 gm. The polyneuritic symptoms developed very rapidly in one of the pigeons, which died two days later. The others were then forcibly fed, in addition to the rice, one with 5 gm. of milk dried at 140° C. for 24 hours and the other with 40 gm. of milk sterilized at from 105 to 110°. The pigeon on the dried milk showed slight signs of improvement for two days, when the symptoms reappeared with fatal results. The other showed marked improvement with gain in weight for about 10 days when symptoms reappeared, but were promptly checked by the administration of yeast.

The antiscorbutic properties of the dried and sterilized milks were tested on guinea pigs. Five groups of 3 each received, respectively, in addition to water, mixed grains heated at 140° for 20 minutes, nonheated grains with 5 gm. of milk powder, nonheated grains with 50 gm. of sterilized milk, and germinated barley dried in the air. The animals in the first group lost weight rapidly and died, those in the second and third groups developed scurvy rapidly and in the fourth group much later, and those receiving germinated barley remained in good health.

The author concludes that desiccation at a temperature of 140° destroys completely the antineuritic and antiscorbutic vitamins of milk, and that a temperature between 105 and 110° attenuates the vitamins in proportion to the duration of heating.

**Biological food tests.—V, The biological value of almond proteins and of almond oil, A. F. MORGAN, B. M. NEWBECKER, and E. BRIDGE** (*Amer. Jour. Physiol.*, 67 (1923), No. 1, pp. 173-192, figs. 2).—This continuation of the series of studies previously noted (*E. S. R.*, 50, p. 462) deals with the biological value of the proteins of almonds and the vitamin A content of almond oil.

It was found that 49 per cent of the nitrogen of almonds can be extracted by distilled water, 27 per cent by 0.1 saturated ammonium sulphate solution, and 27 per cent by 10 per cent sodium chlorid solution. The globulin prepared by dialysis of the 10 per cent sodium chlorid extract did not support normal growth of mice when fed as the only protein at 9, 14, and 18 per cent levels. The washed residue left after the extraction of the globulin with 10 per cent salt solution permitted almost normal growth when fed to rats and mice as the sole protein at a 4.5 per cent level. The mixed proteins obtained by removing the oil from ground blanched almonds with ether sufficed for normal growth of mice when fed at a 17.2 per cent level.

Both mice and rats were used in testing almond oil for its content of vitamin A. The experiments with rats indicated a very slight but insignificant amount of vitamin A. The oil, when fed at a 10 per cent level, did not pre-



vent eye disease, decline, and death of rats on a vitamin A-free diet, but did postpone deficiency symptoms for from 5 to 9 weeks beyond the time at which they would appear on the basal diet alone. When fed at a 20 per cent level the oil was effective for a short period only in the case of rats, but mice fed a diet containing 20 per cent of the oil as the sole source of vitamin A showed no signs of vitamin A deficiency other than a considerably lowered fertility. The authors conclude that mice are unsatisfactory experimental animals in testing for vitamin A.

**Studies of the vitamin potency of cod liver oils.—IV, To what extent is quantitative estimation of vitamin A possible?** A. D. HOLMES (*Jour. Metabolic Research*, 3 (1923), No. 4, pp. 583–587, fig. 1).—This continuation of the series of studies previously noted (E. S. R., 50, p. 665) deals particularly with the author's laboratory technique in examining commercial cod liver oil for potency in vitamin A.

**Differentiation of vitamin A from the antirachitic factor,** E. LESNÉ and M. VAGLIANO (*Compt. Rend. Acad. Sci. [Paris]*, 177 (1923), No. 16, pp. 711, 712).—The authors state that cod liver oil injected subcutaneously has no preventive or curative action for rickets in rats, but, as has previously been demonstrated by Wollmann and Vagliano (E. S. R., 49, p. 666), is capable of promoting growth. This is thought to furnish additional proof that vitamin A and the antirachitic vitamin are not identical.

**Parabiosis in the study of deficiency diseases,** L. R. DRAGSTEDT and E. F. COOPER (*Amer. Jour. Physiol.*, 67 (1923), No. 1, pp. 48–56, figs. 5).—In this study of the mode of action of vitamin A, young rats from the same litter were joined in pairs, or in parabiosis, by an operation similar to that of gastroenterostomy, with the formation of a common intestinal cavity and transposition of the intestines. The effect was then studied of feeding the animals of each pair, both with a complete diet, both with a diet deficient in vitamin A, and one with a diet deficient in vitamin A and the other with a complete diet, followed by a reversal of the diet.

As shown by the weight data and photographs of the various pairs of animals, the feeding or withholding of vitamin A from one animal had no effect upon the other, the results in all cases corresponding with those which would be obtained with separate animals.

In discussing these results, it is pointed out that, while they definitely point to a failure of absorption of vitamin A from the abdominal cavity or at least a failure to perform its function if absorbed, this fact may be interpreted in several ways. It is thought probable that there is no intoxication associated with absence of this vitamin or both animals would have developed symptoms eventually.

**The action of moist heat (autoclave) and dry heat (oven) on vitamin B,** I.-I. NITZESCU (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 36, pp. 1244, 1245).—In a comparative study of the destructive action of dry and moist heat on vitamin B, pigeons were fed wheat, corn, and barley which had in one case been heated in an autoclave at from 115 to 120° C. for one hour and in the other had been subjected to dry heat at 120° for an hour and in some cases an hour and a half.

Of the pigeons fed the autoclaved grains, all died with polyneuritic symptoms in from 31 to 73 days, with the exception of one fed wheat autoclaved for one hour at 110°. This pigeon showed a slight decrease in weight but was otherwise normal. Of the pigeons fed dry-heated grains, none developed polyneuritis. In a third series of experiments pigeons were fed grains autoclaved for an hour at 120° but inclosed in hermetically sealed flasks. Four pigeons thus nourished showed no evidence of polyneuritis after a period of four months.



It is concluded that moist heat is much more destructive of vitamin B than dry heat.

**The rôle of the suprarenals in vitamin B deficiency,** A. VON BEZNÁK (*Biochem. Ztschr.*, 141 (1923), No. 1-3, pp. 1-12).—To determine whether the hypertrophy of the suprarenals following lack of antineuritic vitamin is due to inanition or to specific vitamin deficiency, a comparison was made of the weight of the suprarenals and incidentally of other organs of pigeons, including 10 controls on a complete diet of corn bread and green feed, 19 in a state of severe polyneuritis following a diet of polished autoclaved rice, 6 receiving no food except yeast, and 5 receiving rice and yeast.

The suprarenals of the pigeons on the vitamin B-deficient diet were from two to three times the size of those on the normal diet, while the body weight and the weight of the pancreas, thyroid, liver, and intestines was much lower. It was found that the eyeball remained constant in weight whatever the feeding, and for purposes of comparison the weights of the suprarenals and pancreas were calculated in percentages of this organ. For the suprarenals the figures thus obtained were 3.4 per cent in normal pigeons, 3.1 in pigeons receiving yeast alone, 5 in those in the state of latent avitaminosis, and 9.6 per cent in those suffering from acute polyneuritis. Comparative results for the pancreas were 109, 57, 62, and 55, respectively.

This is thought to prove conclusively that the hypertrophy of the suprarenals is not the result of inanition but of lack of vitamin B. While these results confirm those of McCarrison (*E. S. R.*, 41, p. 264), the adrenalin content of the polyneuritic pigeons showed a decrease rather than an increase in adrenalin production as reported by him.

**Antineuritic value of hog muscle,** R. HOAGLAND (*Amer. Jour. Physiol.*, 67 (1924), No. 2, pp. 300-308).—The experiments reported supplement an earlier study (*E. S. R.*, 49, p. 63) in which evidence was obtained that hog muscle differs from other meats in its relatively high content of antineuritic vitamin. Several additional samples of hog muscle were tested on pigeons for antineuritic properties and were compared with several lots of yeast similarly tested. The meat samples included muscle from fresh pork hams purchased from a local packing house and two samples of fresh ham and one of fresh pork loins supplied by the Bureau of Animal Industry, U. S. D. A. The hams of the hogs from which these samples were obtained had been fed a mixture of 8 parts corn meal, 4 parts wheat middlings, and 1 part fish meal while suckling the pigs. The young pigs were allowed access to shelled corn when two weeks old and the first two to wheat middlings after two weeks. After weaning, the first two were given access to self-feeders containing shelled corn, wheat middlings, and fish meal in separate compartments, and the third was fed shelled corn and fish meal for a time and finally was hand-fed a mixture of 63 parts corn meal, 31 parts peanut meal, and 6 parts cottonseed meal.

The amount of dried muscle fed varied from 5 to 15 per cent, or on the fat-free basis 3.4 to 11.4 per cent of the ration, which consisted otherwise of autoclaved polished rice. Seven rations were fed 26 pigeons in 7 pens for a period of 56 days, and no case of polyneuritis developed. Seventeen birds gained in weight, 1 did not change, and 8 lost slightly. In comparison with these results, 5 per cent of the two lots of dried bakers' yeast tested and 4 per cent of the dried brewery yeast failed to protect pigeons against polyneuritis during a test period of 56 days. Protection was secured by 10 per cent of the bakers' yeast and 8 per cent of the brewery yeast.

**The antiscorbutic vitamin and its dual rôle in nutrition,** G. M. FINDLAY (*Nation's Health*, 5 (1923), No. 9, pp. 589, 590).—This is a general discussion of



the occurrence and properties of vitamin C, together with a description of latent and acute scurvy and of the manner in which a deficiency in vitamin C causes a lowered resistance to bacterial infection (E. S. R., 49, p. 461).

**The blood of pigeons in avitaminosis, I.—I. NITZESCU and I. CADARIU** (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 36, pp. 1245–1247).—Determinations are reported of the number of red blood cells, percentage of hemoglobin, and globular resistance in the blood of pigeons before and after the onset of polyneuritis and of the cholesterol content of these pigeons as compared with normal controls. Three pigeons were fed polished rice, 5 autoclaved corn, and 2 the synthetic vitamin B-deficient ration of Hoet (E. S. R., 50, p. 264).

In all cases the final figures for red blood cells and hemoglobin were lower than before the onset of symptoms of polyneuritis. These results confirm those reported by Weill et al. (E. S. R., 48, p. 761) and indicate further that they are the results of vitamin B-deficiency alone. There was a decrease in the globular resistance and an increase in the cholesterol content. The latter change is considered to be connected in some way with the hypertrophy of the suprarenals following lack of vitamin B.

**The fat content of the blood in avitaminosis, J. A. COLLAZO and G. BOSCH** (*Biochem. Ztschr.*, 141 (1923), No. 4–6, pp. 370–378, figs. 2).—Determinations are reported of the content of total fat, cholesterol, neutral fat, cholesterol esters, and phosphatids of the fresh blood of four dogs on a normal diet and then for several successive weeks on a vitamin-deficient diet of powdered vitamin-free horse meat, rice, lard, and salt mixture. The data reported indicate that during the course of the avitaminosis there is an increase in the total fat of the blood, followed toward the end of the disease by a decrease, but never to the point of normal values. Following a single heavy feeding of fat, the blood fat remained higher for a longer time in avitaminosis than following a similar overfeeding in the course of normal nutrition. The values for cholesterol followed the same course as for fat, while the phosphatid content of the blood remained more nearly normal, but was slightly lower in the last stages of the disease.

**Fat metabolism in avitaminosis, I–III, K. ASADA** (*Biochem. Ztschr.*, 141 (1923), No. 1–3, pp. 166–186; 142 (1923), No. 1–2, pp. 44–52, 165–180).—Three papers are given.

**I. The content of total fat and of cholesterol in the body in normal and avitaminous nutrition.**—In this investigation 27 young rats were fed a vitamin-containing ration and 17 rats of like age and size a supposedly vitamin-free ration for 5.5 weeks, at the end of which time all were killed with ether and analyses made for the content of total fat and cholesterol. Aside from one group receiving in the morning wheat protein, casein, salt mixture, and distilled water and in the evening glucose, wheat starch, butter, lard, yeast, and distilled water, the morning ration of all of the groups consisted of wheat protein 0.5 gm., casein 0.5, salt mixture 0.3, carrots 3 gm. fresh for the vitamin-containing and 0.4 gm. dried for the vitamin-free rations, with distilled water ad libitum. In the evening the different groups received different rations as follows: (1) A mixed ration of lard, wheat protein, casein, wheat starch, and glucose, (2) wheat starch, (3) glucose, (4) lard, and (5) wheat starch and casein, in all cases with distilled water ad libitum. The diets were the same in the other groups with the exception that the morning ration was autoclaved to destroy the vitamins (the temperature of autoclaving not given).

In the animals on the diets deficient in vitamins, the percentage of total and of neutral fat calculated on the fresh body substance was lower than in



the animals on the mixed diet. Among the various groups on the vitamin-deficient rations, the largest amount of fat was found in those receiving a mixed diet and then in decreasing order in those on diets predominating in carbohydrate, fat, and protein, respectively. On the vitamin-containing diets the order was fat, carbohydrate, mixed, and protein. The explanation advanced for the differences noted is as follows:

That the amount of fat deposited in animals on vitamin-deficient diets is smaller on a fat-rich than on a carbohydrate-rich diet is thought to indicate that in vitamin deficiency carbohydrates are burned in increased amounts, followed by fats, but fat formation from carbohydrate is not possible. A decrease in body fat with increase in food fat on a vitamin-deficient diet is interpreted as indicating that the vitamins, probably vitamin A, are essential to fat formation and storage. The lack of fat on a vitamin-free diet furnishing an excess of protein is attributed first to the lack of fat, second to the lack of carbohydrate in the diet, and finally to increased fat destruction. The relatively high fat content of the mixed diet is explained on the ground that in decreasing order the metabolism of carbohydrates, fats, and proteins is affected, and that consequently if all three are present the disturbance is not so great as on a one-sided diet.

The cholesterol content of the animals on the deficient diet was also lower than of those on the complete diet, but the differences were not so marked as in the case of fat. Undernutrition with vitamin-containing mixed food resulted in a lower content of both fat and cholesterol than resulted from a vitamin-free mixed diet.

The general conclusion drawn from this study and previous observations of an increased content of blood fat under similar conditions is that in avitaminosis there is a disturbance in fat transportation resulting in an increased transportation of food and body fat to the site of oxidation, the blood.

II. *The content of the blood of normal, starving, avitaminous, and phosphorus-poisoned rats in total fat, neutral fat, cholesterol, and cholesterol esters.*—In a further attempt to explain the disturbances in fat metabolism in avitaminosis, a comparison was made of the content of fat (including total and neutral fat, cholesterol, and cholesterol esters) in the blood of normal and phosphorus-poisoned rats following the feeding of a vitamin-rich diet, a 4-day starvation period, and the feeding of a vitamin-deficient diet, respectively. Thirty-five animals were used in the experiment. The diet consisted of polished rice 7, lard 3, wheat protein 0.5, casein 0.5, carrots fresh 3, or dried 0.4, and Osborne and Mendel's salt mixture 0.3 gm., with distilled water ad libitum. For the vitamin-deficient diet the lard was autoclaved for 5 hours at 155° C. and the other food materials for 3 hours at 130°. These diets were fed for 70 days and in some cases 111 days before the blood analyses were made. The phosphorus-poisoned animals received a single injection of a 1 per cent solution of phosphorus in olive oil 4 days before the blood analyses were made.

As has been previously noted by various investigators, the blood fat of the animals on the vitamin-free diet was higher than of those on the normal diet, which in turn was higher than of the starving animals. Phosphorus poisoning increased still further the amount of fat in the blood of animals which had been for 70 days on the deficient diet and to a less extent that of the starving animals, but did not alter materially the amount of fat in the blood of the vitamin-fed animals. Analyses after 111 days gave values for the animals on the vitamin-deficient diet corresponding more closely with the normally fed animals. The content of cholesterol and cholesterol esters in the blood was higher in the animals on the vitamin-deficient diet than in the normal

or starving animals, and was increased in every case by the phosphorus poisoning except in the last stages of avitaminosis, when the cholesterol value decreased.

The increase in blood fat following phosphorus poisoning in the hyperlipemic state of avitaminosis, in contrast to the unaltered blood fat of normally nourished animals, is thought to indicate that the fat mobilized through the poisoning can not be removed from the blood in avitaminosis as under normal conditions, thus showing an impaired absorption capacity of the cells. The lowered content in the later stages of avitaminosis is explained by the exhaustion of the cells in fat and the consequent failure to pour more fat into the blood stream.

III. *The fat and cholesterol content of the liver following phosphorus poisoning in normal, starving, and avitaminous rats.*—The above study has been extended to an analysis of the livers of rats fed in like manner.

The total fat content of the liver decreased in the course of the vitamin-deficient feeding until near the end of the disease, when it increased. After four days of starvation the fat content reached a value corresponding to that of the middle period of avitaminosis. The cholesterol content of the liver was higher in starvation, but decreased progressively in avitaminosis.

Following phosphorus poisoning, the total fat content of the liver decreased in the starving, but increased in the normal and avitaminous animals. Following severe poisoning, with sudden death, the total fat content of the completely avitaminous liver was higher than that of the even more severely poisoned normal animals, but the life of the poisoned animals on the normal diet was longer than that of the animals on the deficient diet. The cholesterol content of the liver of the phosphorus-poisoned animals on a normal diet showed an inconstant increase, that of the liver of phosphorus-poisoned avitaminous animals an increase, and of starving animals a decrease.

*The cephalin and lecithin content of the brain in avitaminosis*, H. NAITO (*Biochem. Ztschr.*, 142 (1923), No. 5-6, pp. 385-392).—From studies conducted on guinea pigs and rats the author concludes that in avitaminosis there is a quantitative decrease in the amount of brain tissue, but that there is no alteration in the proportion of cephalin and lecithin.

*The phosphorus metabolism in avitaminosis*, K. MORINAKA (*Biochem. Ztschr.*, 142 (1923), No. 5-6, pp. 381-384).—The author reports the phosphorus content of the liver of rats on a vitamin-free diet to be the same as of those on a normal diet and not to be altered by the form in which the phosphorus is fed, whether organic or inorganic.

*The alkali reserve of the blood plasma in avitaminosis*, J. A. COLIAZO (*Biochem. Ztschr.*, 140 (1923), No. 1-3, pp. 254-257).—Determinations by the Van Slyke method are reported on the alkali reserve of the blood of dogs, guinea pigs, and pigeons before and after subsisting for some time on a vitamin-deficient diet. All received a salt mixture of sodium chlorid 250, calcium lactate 100, magnesium citrate 100, and ferric citrate 25 parts. The food given the dogs consisted of vitamin-free horse meat, polished rice, and lard. The guinea pigs were fed dried oats and the pigeons polished rice, all with water ad libitum. One dog received only the salt mixture and water.

The average values for the CO<sub>2</sub>-combining capacity of the blood of the various animals in normal condition and in avitaminosis were as follows: Dog 0.68 and 0.51, guinea pig 0.53 and 0.37, and pigeon 0.57 and 0.52, respectively. The slight lowering in alkali reserve is attributed to inanition rather than to vitamin deficiency, particularly since the greatest difference was noted in the guinea pigs which refused food earlier and in the other animals at the end



of the experiment when they were eating less. In the dog receiving only salt mixture there was a very rapid lowering of the alkali reserve.

**Investigations on the intermediary carbohydrate metabolism in avitaminosis.—I, Glycogen formation and exchange in avitaminosis,** P. RUBINO and J. A. COLLAZO (*Biochem. Ztschr.*, 140 (1923), No. 1-3, pp. 258-267, fig. 1).—Experiments are reported in which normal and polished rice-fed pigeons were forcibly fed glucose, and at varying intervals of time thereafter were killed and their livers and muscles analyzed for glycogen.

It was found that in all cases the feeding of glucose was followed by a rapid increase in the glycogen content of the liver and to a lesser extent of the muscle. In the pigeons on the vitamin-free diet this was followed by a rapid decrease in glycogen, while in the normal animals this was not the case. Similar results were obtained with other sugars, although the extent of glycogen formation differed with the kind of carbohydrate fed. At the time when the glycogen content of the liver of normal and of rice-fed pigeons was the same, the latter had already begun to show polyneuritic symptoms. At this time, however, there was a decided difference in the reducing value of the blood, which had already begun to decrease.

The general conclusion drawn is that in avitaminosis the body has not lost its power to form glycogen, but that there is rather a decreased power of storage or an increased tendency toward the breaking down of the glycogen.

**The mechanism of the action of insulin.—Contribution to the disturbances in carbohydrate metabolism in avitaminosis,** A. BICKEI and J. A. COLLAZO (*Deut. Med. Wchnschr.*, 49 (1923), No. 45, pp. 1408-1410).—Attention is called to the resemblance in the disturbance in carbohydrate metabolism in diabetes and in the deficiency disease induced in pigeons by a polished rice diet (*E. S. R.*, 49, p. 565). Experiments are reported in which the similarity in reaction was tested still further by the administration of insulin to normal pigeons and to pigeons which had been fed to from 28 to 32 days on polished rice and salt mixture. The normal pigeons, weighing from 350 to 500 gm., were able to withstand the subcutaneous injection of 3 units of insulin, while the injection of 5 units proved fatal. The blood sugar sank from 0.2 to 0.1 per cent. The content of fat and amino acids in the blood was only slightly affected. In the polyneuritic pigeons the blood sugar sank to 0.065 per cent following the injection of from 1 to 2 units of insulin. Repeated injections of 0.5 unit at intervals of several hours prolonged the life of the pigeons, but the results were uncertain. One pigeon was kept alive for 55 days and another for 80 days by the injection of 2 units of insulin every other day. During the insulin treatment the body weight was maintained. The ability to fly, which was lost before the beginning of the insulin treatment, was not restored.

When pigeons were forcibly fed with sugar after the fourth week of polished rice feeding and were given an injection of 2 units of insulin an hour later no convulsions followed, and the pigeons remained alive. One pigeon was kept alive for 6 days after 30 days of polished rice feeding by the daily feeding of 6 gm. of sugar without the rice, but with the injection into the liver of 0.5 unit of insulin twice daily. On the seventh day the pigeon died in convulsions. Several pigeons which had been kept for 30 days on polished rice were fed 6 gm. of glucose and at the same time received an injection of 2 units of insulin. These were killed 2, 6, and 24 hours later and their livers and muscles analyzed for glycogen. There was a marked increase in the glycogen content after 6 hours, with subsequent decrease. The period of highest glycogen content was that of lowest blood sugar, blood fat, and amino acid.

The conclusion is drawn that insulin temporarily restores the ability of the muscles and liver to synthesize glycogen, and the suggestion is made that the deranged sugar metabolism following deficiency in antineuritic vitamin is the result of a functional disturbance of the islands of Langerhans as of the other glands of internal secretion. The possibility is also suggested that insulin contains vitamin B, and in support of this attention is called to the fact that many of the sources of glucokinase are also good sources of vitamin B.

[**Insulin studies**], I—IV (*Amer. Jour. Physiol.*, 67 (1923), No. 1, pp. 57–82).—The four papers noted below are a contribution from the Hull Physiological Laboratory of the University of Chicago.

I. *Preparation of insulin*, N. F. Fisher (pp. 57–64).—In the course of preparing insulin from ox pancreas by the Doisy, Somgyri, and Shaffer method, it was found that on precipitation with 9 volumes of alcohol two distinct substances separated out. By first using 1 volume of alcohol a dark gray precipitate was thrown down. On filtering this and adding 8 volumes of alcohol to the filtrate a white precipitate was formed. The first precipitate proved to be highly toxic, to raise the blood sugar, and to cause death in rats and guinea pigs by excessive stimulation of the medullary centers. The other material is thought to be the specific antidiabetic substance, insulin. The toxic fraction is considered to be responsible for the irritation and sterile abscesses occasionally produced by insulin at the site of injection. It is noted that pancreas obtained from old cows yields very much less insulin than that obtained from calves.

II. *The absorption of insulin from the intestine, vagina, and scrotal sac*, N. F. Fisher (pp. 65–71).—Using dogs and rabbits as experimental animals, it was found that injections of insulin into the scrotal sac of rabbits “yield the maximum effect per unit of insulin, a prompt action, and of long duration, without apparent irritation.”

The introduction of insulin into the intestines of dogs through a Thiry fistula was followed by rapid absorption, lowering of the blood sugar, and rapid elimination by the kidneys. A similar rapidity of absorption, with a temporary lowering of the blood sugar, was noted when insulin was given by the vagina.

III. *Excretion of insulin by the kidneys*, N. F. Fisher and B. E. Noble (pp. 72–76).—It is reported that insulin can be recovered from the urine of diabetic dogs in amounts varying with the rate at which it enters the blood stream and with the method of administration, more being recovered when given by the vaginal, oral, or intestinal route than when given subcutaneously. The administration of large amounts of insulin orally produced hypoglycemic convulsions in normal pups.

IV. *An insulin-like substance in the kidney, spleen, and skeletal muscle*, J. S. Ashby (pp. 77–82).—Using the method employed in the first study of the series with fractional precipitation by alcohol, the author has succeeded in extracting from the kidney, the spleen, and the muscle of normal dogs and cattle a substance possessing an insulin-like action in reducing the blood sugar of rabbits. In all of these preparations a toxic fraction first separated out. The insulin extract prepared from the kidney maintained hypoglycemia for 24 hours or more.

**The usefulness of vitamin B and levulose in the insulin cure**, A. DESGREZ, H. BIERRY, and F. RATHERY (*Compt. Rend. Acad. Sci. [Paris]*, 177 (1923), No. 17, pp. 795–797).—A limited amount of evidence is presented indicating that the administration of levulose and extracts rich in vitamin B to diabetics undergoing treatment with insulin makes it possible to use smaller amounts of insulin and administer it at longer intervals.



**Investigations on iodine metabolism.—I, Experiments with physiological amounts of iodine in adults,** T. VON FELLEBERG (*Biochem. Ztschr.*, 142 (1923), No. 3-4, pp. 246-262, fig. 1).—Using the previously noted method of determining minute amounts of iodine (E. S. R., 50, p. 608), the author has studied his own metabolism of iodine for a period of two months, during which time the amount of iodine in the food varied from 14.3  $\gamma$  (14.3 millionths of a gram) to 77  $\gamma$ . The smaller amount, which was considered to be the amount upon which equilibrium is obtained, represented the iodine content of an ordinary mixed diet of bread 500 gm., milk 1 liter, butter 40 gm., hardened plant oil 20, cheese 80, currant jam 50, cocoa 8, sugar 15, apples 300, and potatoes 250 gm. To increase the amount of iodine, potassium iodide, cod liver oil, sardines, and watercress were used at different times. Iodine determinations were made on the food, feces, urine, nasal secretions, and perspiration. The results obtained are summarized as follows:

The largest proportion of iodine taken in physiological amounts is excreted in the urine. The excretion in the feces is variable. A very small amount, independent of the food, is excreted in the nasal excretion and perspiration. The excretion of iodine is not influenced by the ingestion of potassium bromide, sodium fluoride, common salt, or by drinking large amounts of water. A larger proportion of iodine is excreted through the skin following a Turkish bath, but the total excretion is not affected. Physical exercise causes not only an increased excretion through the skin, but also an increase in the total excretion. Fever also increases the total excretion, while fasting decreases the excretion. The excretion is smaller at night than during the day.

With 14  $\gamma$  of iodine daily over a long period of time, a balance is obtained between the income and outgo. With larger amounts of iodine, from 50 to 80  $\gamma$  daily, an easily mobilized iodine reserve results, which can be utilized following a lowered intake. There is also a second or potential reserve which depends upon the iodine content of the thyroid gland. The deposition and excretion of iodine are considered to depend in part upon the form in which the iodine is taken. In the present investigation iodine-containing fat, cod liver oil, was absorbed best, followed by iodine in plant form, watercress, and in animal form, sardines.

**Pathogenesis of deficiency disease.—XI, Observations on fat excess in relation to iodine requirements and to the thyroid gland,** R. MCCARRISON (*Indian Jour. Med. Research*, 11 (1923), No. 1, pp. 1-51, figs. 45).—The studies reported in this extension of the investigation previously noted (E. S. R., 44, p. 667) have been noted from other sources (E. S. R., 46, p. 565; 50, p. 668).

**Studies on the cause and treatment of beriberi in Japan,** K. OHOMORI (*Japan Med. World*, 3 (1923), No. 11, pp. 231-238).—This is a general summary of the history of beriberi in Japan and of investigations conducted in that country on the cause, prevention, and cure of the disease.

**The relation of food to the causation of disease in the Tropics,** P. W. BASSETT-SMITH (*Roy. Soc. Trop. Med. and Hyg. Trans.*, 17 (1923), No. 4, pp. 223-245, figs. 6).—In this address before the Royal Society of Tropical Medicine and Hygiene, the author classifies tropical diseases directly due to diet as those caused by oversupply, the deficiency of certain necessary constituents, bacterial or protozoal infection of food, introduction of parasites with food, and poisons in food. Each of these is discussed briefly.

## ANIMAL PRODUCTION.

**Investigations in feed conservation.—I, The so-called sweet green feeds,** G. WIEGNER, E. CRASEMANN, and J. MAGASANIK (*Landw. Vers. Sta.*, 100 (1923), No. 3-5, pp. 143-268).—After extensively reviewing the works of other

investigators dealing with the composition and feeding value of silages, the authors give the analyses both on the total and dry matter basis of 21 samples of silage made from the grasses and clovers during the years 1917 to 1921 at the Technical High School at Zurich.

In considering the effect of the content of one constituent on another, the samples were divided into groups consisting of those having the largest, smallest and medium amount of each ingredient. On this basis it was evident that the water and fiber contents of the silage, which are somewhat dependent on the time of harvest, had significant influences on the content of volatile and nonvolatile acids and proteins and the digestibility of the proteins. The three groups of samples having average water contents of 75.06, 68.61, and 58.16 per cent had free lactic acid contents of 0.59, 1, and 1.33 per cent, respectively, and contained 3.14, 1.5, and 0.6 per cent of volatile acids. With a high fiber content in the silage, the percentage of protein and amids, and the digestibility of the protein were reduced, but the content of volatile acids was increased, due to the incorporation of oxygen by a fibrous feed, making favorable conditions for acetic acid fermentation.

The chemical changes occurring in silage which was well packed and other silage loosely packed were compared. It was shown that the loosely-packed silage developed considerable heat at first, but there was no evidence of this being due to fermentation since there was no increased development of either volatile or nonvolatile acids until after the temperature was reduced. The respiration of the living plant cells is thought to have caused the increased heat production. Fermentation apparently started more rapidly in the thoroughly packed silage from which a large portion of the air had been removed. The loosely-packed silage showed less loss of nitrogen-free extracts than the more closely-packed silage, but there was also a greater reduction in the amount of carbohydrates and the digestibility of the proteins. Less lactic but more acetic acid were produced in loosely-packed silage.

The composition, digestibility, and loss of nutrients occurring in silage prepared by different methods were compared with like factors for dry hay in 1920. On a hectare basis it was found that 14,387.8 kg. of silage containing 58.83 per cent water or 7,672.3 kg. of hay containing 10.33 per cent water could be produced. The silage was harvested about three weeks earlier than the hay, but as shown by the analyses which are given in detail both were of good quality.

The following digestibility coefficients determined with wethers were calculated for the silage and hay, respectively: Organic matter 72.25 and 67.80 per cent; crude protein, 63.79 and 62.60; pure protein, 45.43 and 55.89; crude fat, 68.99 and 53.59; crude fiber, 72.92 and 65.63; and nitrogen-free extract, 75.38 and 71.79 per cent. Thus the organic matter, fat, crude fiber, and nitrogen-free extract were better digested in the silage than in the hay. In comparing the energy value of the dry matter of the two feeds, it was estimated that 1 kg. of dry matter in the hay was equal to 0.829 kg. of dry matter in the silage. It was concluded, however, that a greater amount of energy and slightly more digestible energy could be produced per acre in the form of hay than as silage, especially during good seasons for curing hay.

A brief report of the digestible organic substance and digestible pure protein produced on a unit area with fresh green grass as 100 in each case were: Hay, 79.4 and 59.7; silage, 68.1 and 30.7; and electrically preserved feed, 67.2 and 28.6. The coefficients of digestibility of the different constituents of these feeds are also given.

The loss in preserving grass as hay, silage, or by electrical methods, G. WIEGNER, E. CRASEMANN, and M. KLEIBER, (*Landw. Jahrb. Schweiz*, 37 (1923),



No. 4, pp. 435-496).—This work consists largely of a detailed report of the comparison of the nutrients and their digestibility found in green grass and in the hay, silage, and electrically preserved feed made from the grass, of which a brief summary was noted at the conclusion of the above paper. Based on the starch equivalent in the feeds, 100 kg. of grass containing 75 per cent of water was found to be equal to 91 kg. of silage containing 65 per cent of water, 130 kg. of electrically preserved feed containing 75 per cent of water, or 42 kg. of hay containing 14 per cent of water. One hundred kg. of dry matter in the grass were found to furnish the following amounts of digestible nutrients when preserved in the different ways (based on digestion experiments with wethers):

*Digestible nutrients in the dry matter of the grass from equal areas recovered in the preserved feeds.*

Source.	Total dry matter.	Digestible nutrients.				
		Organic matter.	Crude protein.	Crude fat.	Crude fiber.	N-free extract.
	Kg.	Kg.	Kg.	Kg.	Kg.	Kg.
Grass-----	100.00	60.18	9.57	1.72	19.37	29.52
Silage-----	78.52	40.97	5.13	1.40	17.31	17.13
Electrically treated feed-----	83.36	40.41	4.43	.98	17.92	17.08
Hay-----	85.78	47.76	7.29	1.28	17.92	21.27

**West Virginia pastures**, C. E. STOCKDALE (*West Virginia Sta. Circ.* 35 (1924), pp. 4).—This is a summary of Bulletin 177 (E. S. R., 48, p. 168).

**Management of range grazing land**, J. T. JARDINE, H. A. LINDGREN, and E. L. POTTER (*Oreg. Agr. Col. Ext. Bul.* 366 (1923), pp. 16).—The adaptability of different ranges to various types of livestock, the management of the range to prevent overgrazing and to improve a poor stand of grass, and the management of cattle and sheep on ranges are discussed.

**The degeneration of the testes of rats on a milk diet**, H. A. MATTILL and J. S. CARMAN (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 7, p. 420).—The testes of male rats fed at the University of Rochester on a ration of 2 or 5 per cent of dried kidney or liver or 2 per cent of thymus or 2 per cent of yeast nucleic acid with 50 per cent of dry whole milk, 15 per cent of lard, 2 per cent of salt, and starch have been observed to begin to atrophy or degenerate as early as 155 days of age. Pathological changes were evident by the glands collapsing when ruptured and an exudation of a clear, colorless fluid. The germinal epithelium showed degeneration, with an abundant proliferation of the interstitial tissue and the presence of amorphous areas.

**Studies on the physiology of reproduction in birds**, XVII-XVIII, O. RIDDLE and H. E. HONEYWELL (*Amer. Jour. Physiol.*, 67 (1924), No. 2, pp. 333-336; 337-345, fig. 1).—Two parts of this series are here given.

**XVII. Blood sugar and ovulation under inactivity or close confinement**.—The sugar content of the blood of pigeons held in close confinement for from three to five weeks was reduced in different groups from averages of 181 to 132, from 175 to 119, and from 178 to 127 mg. per 100 cc. of blood. Upon return to a place where normal activity was possible, the sugar content of the blood returned to normal. During confinement no eggs were laid, though the birds were ovulating previous to the confinement period. Thus, the reduction in the sugar content of the blood is probably an important factor in suppressing laying in confined birds. The relation between blood sugar and ovulation has been previously established (E. S. R., 48, p. 273).

**XVIII. Effects of the onset of cold weather on blood sugar and ovulation rate in pigeons.**—In the studies of blood sugar in pigeons at the Carnegie Station for Experimental Evolution, it was found by a review of previous records that the sugar content of the blood decreased with the cold weather in the fall. The amount of decrease seemed to be dependent upon the prevailing temperature and on the exposure of the birds. The number of ovulations, as determined by the eggs laid, was also shown graphically to follow rather closely the changes in temperature during the fall and early winter, and a similar relationship existed throughout the year. The percentage of single ovulations also increased during the colder seasons. These results indicate a further factor influencing the blood sugar content, and thus ovulation.

It has now been shown that reductions in blood sugar, which reduce ovulation, may also be brought about by insulin, confinement, cold, and the size of the suprarenals. The relation of the blood sugar and ovulation to basal metabolism does not seem to be constant.

**Thyroparathyroidectomy in the rabbit,** S. SIMPSON (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 7, pp. 411, 412).—Two experiments, in which 17 half-grown and 24 mostly adult rabbits were thyroparathyroidectomized at the Cornell Medical College, are described. In the first lot only 2 died within a short time, but in the second lot 16 died within 18 days, showing symptoms of acute tetany. Accessory parathyroid tissue in some animals has been suggested as a cause for the variations in the results of parathyroidectomy experiments, but the differences in the diet are offered by the author as a more probable cause, based on the results of Dragstedt and Luckhardt in dogs. The toxic substances are thought to be produced in the gastrointestinal tract by the action of proteolytic bacteria. The diet of the first group of rabbits consisted almost entirely of green clover, but oats and cracked corn with a little cabbage formed the diet of the second group.

**Simple empirical formula for expressing the lineal growth of the human fetus,** R. E. SCAMMON and L. A. CALKINS (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 6, pp. 353-356).—Several formulas are suggested for calculating the age of human fetuses, based on the length of the fetus and constants determined from the data of Keibel and Mall.

**[Feed cost of boars and sows],** W. S. BLAIR (*Canada Expt. Farms, Kentville (N. S.) Sta. Rpt. Supt.* 1922, p. 14).—In raising a boar from one to two years of age, it was found to require 1,619 lbs. of grain and 3,250 lbs. of mangels at a calculated cost of \$44.54. In another experiment 1,648 lbs. of grain, 3,100 lbs. of roots, and 827 lbs. of skim milk were required to carry a sow one year at a calculated cost of \$46.48.

**A study of livestock in eastern Kongo,** J. MARCQ (*Ann. Gembloux*, 30 (1924), No. 1, pp. 44, pls. 2).—This is a discussion of the different types and breeds of livestock found in eastern Kongo with relation to the production of the animals and the prevalence of diseases.

**Studies in animal nutrition.**—V, **Changes in the composition of the mature dairy cow while fattening,** R. C. MOULTON, P. F. TROWBRIDGE, and L. D. HAIGH (*Missouri Sta. Research Bul.* 61 (1923), pp. 3-20).—Three Jersey cows which had been on maintenance rations for several months were selected for a study of the changes in composition of the body of dairy cows during fattening.

One cow was slaughtered and the different organs and parts of the animal analyzed much as in the previous study (E. S. R., 48, p. 474). When each of the other cows had attained the same condition as the slaughtered animal they were started on fattening rations. One cow received a daily ration consisting of corn chop, bran, and linseed meal 4:2:1, with alfalfa hay and silage for



130 days, at the end of which time she was declared as fat as she would get on the ration, having gained 151.4 lbs. The other cow received a beef ration of corn chop and linseed meal 8:1, with four-tenths as much alfalfa hay as grain for 160 days, during which time she gained 294.3 lbs. This cow became pregnant prior to the test, and she was also 2 years 6 months younger than the other cow which was fattened. Both cows received similar amounts of feed, but since 50 per cent greater daily gains were made on the beef ration a more economical utilization of food was effected. At the conclusions of the fattening periods both cows were slaughtered and the entire animals analyzed.

The changes in the proportions of the parts and organs indicate that the fattening developed the noncarcass parts of the animals more rapidly than the carcass parts. Based on the proportions of the parts in the cow slaughtered before fattening, the following percentage increases in the two cows fattened on the dairy and beef rations, respectively, were calculated: Live weight 12.43 and 37.84 per cent, lean carcass 5.9 and 31.35, fat carcass 69.41 and 71.29, bone carcass 3.95 and 10.98, total fatty tissue 84.21 and 109.39, and offal fat 125.66 and 209.86 per cent. Chemical analyses of the different parts showed that fattening tends to increase the proportion of fat in the body, with decreases in the proportion of all other constituents. The greatest increases in the fat occurred around the internal organs, little being added to the edible portions. The differences observed in the two fattened cows are attributed to individuality rather than to differences in the ration fed. All data on the composition of each cow are tabulated in detail.

**Steer feeding experiments at the Pennsylvania State College**, W. H. TOMHAVE and F. L. BENTLEY (*Pennsylvania Sta. Bul.* 183 (1923), pp. 3-16, figs. 6).—The results of the feeding experiments with 2-year-old steers, carried on during six winters (from 1916 to 1922) and previously noted from other sources (*E. S. R.*, 49, p. 268), are summarized.

**Study of the size of lambs at birth**, M. LAPLAUD and A. DUFFAU (*Rev. Zootech.* [Paris], 2 (1923), Nos. 11, pp. 320-326; 12, pp. 416-425).—The weights and chest measurements of the lambs born during 1920-21 and 1921-22 in five flocks at Vaulx-de-Cernay, have been studied in relation to their sex and the number born to each ewe and in relation to the weights and ages of the dam and sire. The ewes of one Southdown, two Charmoise, and one Merino flocks were classified according to age and the mean ratio at the different ages of the weights of the lambs to that of the ewes. Similar studies were made of the lambs produced in crossbred flocks, Southdown-Limousine and Charmoise-Limousine. Fairly constant relations between the weights of the lambs and their dams were observed, averaging about 1:15, but there was no such close agreement with the weights of their sires, the ratios varying from 1:18 to 1:28. The male lambs were usually heavier than the females, and the combined weight of twins was greater than the weight of singles.

**Open-air pig breeding, scientific and practical**, M. J. ROWLANDS (*London: Vinton & Co., Ltd.*, 1923, pp. XIV+233, pls. 24, figs. 2).—This is a practical manual on hog raising.

**Further studies on "posterior paralysis" in swine**, L. A. MAYNARD, S. A. GOLDBERG, K. V. WILLIAMS, and O. B. CHRISTY (*Soc. Expt. Biol. and Med. Proc.*, 20 (1923), No. 8, pp. 528-530).—In continuing the studies of posterior paralysis in swine (*E. S. R.*, 48, p. 271), characteristic symptoms were produced in a lot receiving a ration of yellow hominy, middlings, and casein made into a slop with an equal weight of skim milk, but the trouble did not develop in a check group receiving the same ration with the addition of calcium carbonate and bone meal. In the animals developing the paralysis, the addi-



tion of minerals or 10 cc. of cod liver oil daily was found to alleviate the condition. In another experiment, pigs on similar rations even with minerals developed the trouble, and neither cod liver oil nor orange juice seemed to prevent it, although chopped alfalfa hay did.

The principal and constant lesions in the pigs showing paralysis were in the bones and kidneys. Eight pigs also showed acute pneumonia. The bone lesions were most frequently seen at the ends of the femur where the epiphyseal cartilage was thicker than normal. The marrow spaces were filled with fibroblasts, newly formed blood vessels, and hemorrhage. Irregularities in calcification and the occurrence of hemorrhage were the most constant bone lesions. The kidneys showed hyperemia of the glomeruli and albumin casts in the convoluted tubules, with slight cloudy swellings.

In discussing the results the authors suggest that both scurvy and rickets may be causing the external symptoms.

**Sterility in swine**, G. F. FINLAY (*Natl. Council Pig Breeders and Pig Feeders Bul. 1* (1924), pp. 24, fig. 1).—This is a popular discussion of the causes of sterility and low fertility in swine.

**Practical feeding investigations with swine dealing with comparisons of fish meal and other protein-rich feeds**, J. LANDIS (*Landw. Jahrb. Schweiz*, 37 (1923), No. 5, pp. 595–644, pl. 1, figs. 12).—The results of comparative feeding experiments, carried on at four different places in Switzerland to compare fish meal with other protein-rich supplements, are reported.

In one experiment, conducted at the Dairy School at Rutti-Zollikofen, three lots of 5 pigs each were fed for 24 weeks. In addition to a basal ration of corn, barley, potatoes, curds, and buttermilk, lot 1 received 1.5 kg. of skim milk per head daily, with increases of 0.3 kg. every week. Lots 2 and 3 received 125 gm. of fish meal containing 51.5 and 58.9 per cent protein, respectively, per pig daily, with increases of 25 gm. every week until a maximum of 250 gm. was reached. At the end of the first 11 weeks' feeding, the protein supplements were reduced to 0.6 kg. of skim milk and 50 gm. of fish meal to the end of the experiment. The respective average daily gains per pig made in the different lots during the two periods were lot 1, 0.588 and 0.598 kg., lot 2, 0.547 and 0.505 kg., and lot 3, 0.530 and 0.526 kg. There were no significant differences in the dressing percentages or in the hardness of fat of the pigs of the different lots, but the quality of the carcasses was slightly better in lot 2.

Two groups of 10 pigs each averaging 21 kg. in weight were selected at an insane asylum near Bern to compare sesame cake meal and fish meal as supplements to a basal ration in amounts of 125 gm. per day per pig of each, with increases of 25 gm. each week to a maximum of 250 gm. During 12 weeks' feeding on these rations the pigs made average daily gains of 0.448 kg. on sesame cake and 0.479 kg. when fish meal was the supplement. In a final fattening period of 20 weeks, during which both the fish meal and sesame cake were reduced and toward the end the fish meal was replaced with sesame cake, the average daily gains were 0.607 and 0.573 kg. in the respective lots. The quality of the carcasses and the dressing percentages were similar in both cases.

In an experiment at a cooperative chocolate factory in Schwarzenburg two lots of 10 pigs each averaging about 10 kg. in weight were fed on a basal ration of whole milk, skim milk, buttermilk, barley, oats, corn, and potato meal, with supplements of linseed meal in lot 1 and fish meal in lot 2. During a period of 12 weeks the pigs receiving linseed meal made average daily gains of 0.391 kg., as compared with 0.417 kg. by the pigs receiving fish meal.

The fourth experiment was carried on at a cooperative brewery near Bern with two lots of 8 pigs each averaging from 42 to 45 kg. in weight. The basal ration consisted of garbage, brewery waste, and dried vegetables. The protein



supplements to this ration were peanut meal in lot 1 and fish meal in lot 2 fed at the same rate as the fish meal in the first and second experiments. The average daily gains made were 0.444 kg. by lot 1 and 0.373 kg. by lot 2.

The combined results of the four experiments showed no significant differences in the gains made and the economy of the utilization of the feeds when fish meal was compared with the other protein feeds.

**Missouri State Poultry Association yearbook, 1921** (*Missouri Poultry [Sta.] Bul.* 30 [1922], pp. 140).—This is the annual report of this association for the year 1921, containing several short articles on poultry subjects and other information of primary interest to Missouri poultry breeders.

The results of an experiment, carried on by S. C. Ellis, in substituting 20 lbs. of cottonseed meal and 50 lbs. of skim milk for 12 lbs. of meat scrap in the mash fed to Brown Leghorn hens are also reported. In eight months the birds receiving the cottonseed meal and skim milk averaged 115 eggs per hen, whereas those receiving the meat scrap averaged 124 eggs. The eggs from the cottonseed meal pen had a higher percentage of fertility, hatchability, and vitality than the others. The protein content of the eggs from the cottonseed meal pen was also higher.

In another experiment cottonseed meal with whole milk, peanut meal with skim milk, and linseed meal with buttermilk were compared as ingredients of mashes for baby chicks up to five weeks of age. The average gains per chick were, respectively, 5.75, 8.14, and 6.29 oz. as compared with 3.78 oz. by the control. Analyses of the mashes fed and the droppings are also given.

**Missouri State Poultry Association yearbook and biennial report of the Missouri State Poultry Board, 1921-1922** (*Mountain Grove: Missouri State Poultry Assoc.*, [1923], pp. 137, figs. 9).—This report of the association for the year 1922 contains a number of popular articles and other information of interest to the poultry breeder.

**Animal protein for laying hens**, W. F. SCHOPPE (*Montana Sta. Bul.* 161 (1923), pp. 10, fig. 1).—This is a more detailed report than that previously noted (E. S. R., 38, p. 373) of the three years' experiments carried on in 1914-15, 1915-16, and 1916-17, in which Single Comb White and Brown Leghorns receiving well-balanced basal rations of a scratch feed and mash were given access to skim milk, meat scrap, fish scrap, or ground green bone. The addition of the animal protein to the basal ration, which included a mash containing about 13 per cent of meat scrap, was found to increase the egg production, decrease the cost of eggs, and increase the profits.

The relative price of the different animal proteins should largely determine the kind of protein to be used, but skim milk or ground green bone are preferred when they are available.

**"Vitamin A" deficiency in poultry**, J. R. BEACH (*Science*, 58 (1923), No. 1513, p. 542).—A disease resembling roup has been observed in poultry at the California Experiment Station which has been found to be due to a lack of vitamin A. "In these experiments 11 pens of 15 fowls each were fed a basal ration of mixed grains and meat scrap properly balanced for poultry but containing no yellow corn. No other food was given in pen 1, the control. In pen 2 the basal ration was supplemented by a salt mixture consisting of calcium carbonate, calcium phosphate, sodium chlorid, sodium sulphate, and iron sulphate; in pen 3 by buttermilk; in pen 4 by cod liver oil; in pen 5 by dried yeast; in pen 6 by orange juice; in pen 7 by cod liver oil and dried yeast; in pen 8 by cod liver oil and orange juice; in pen 9 by dried yeast and orange juice; in pen 10 by cod liver oil, dried yeast, and orange juice; and in pen 11 by lawn clippings.



"None of the fowls in the pens which have received cod liver oil or lawn clippings have been affected, but the disease has occurred in all other pens, affecting 11 of the 15 fowls in pen 2, which were fed buttermilk, and all the fowls in the other pens."

**Relation of minerals to health of fowls**, B. F. KAUPP (*Poultry Item*, 26 (1923), No. 2, pp. 14, 18).—To study the value of minerals in the rations of growing chicks, lots of Single Comb Rhode Island Reds, Single Comb White Leghorns, Partridge Plymouth Rocks, and White Faced Black Spanish chicks were raised from hatching to eight weeks of age at the North Carolina Experiment Station on a scratch ration of cracked corn, cracked wheat, and pinhead oats 50:33:17, and a basal mash of fish meal, wheat middlings, pulverized oats, and corn meal 15:20:20:40. To every 95 lbs. of mash fed to a part of the lots, 4.5 lbs. of bone meal and 0.5 lb. of salt were added. It is stated that the bones were larger and the birds were stronger in the lots receiving minerals, and the average weights were also somewhat greater.

**The variability in the gross body weight and the weights of the liver, feathers, and blood of 131 chickens**, H. B. LATIMER and L. T. PEDERSEN (*Poultry Sci.*, 3 (1923), No. 1, pp. 11-14).—Based on data presented in a paper by Zaitschek (*E. S. R.*, 20, p. 273) giving the live weight, dressed weight, and the weight of the liver, feathers, and blood of 131 chickens, the authors have calculated the mean standard deviation and coefficient of variability for each character and the coefficient of correlation between the body weights and the weight of the organs, with the probable errors for each constant.

**Can the body temperature of a hen be used as a clue to her egg-laying capacity?** F. M. FRONDA (*Poultry Sci.*, 3 (1923), No. 1, pp. 34-38).—The relation of body temperature to the egg production of fowls has been studied at the New York Cornell Experiment Station by correlation coefficients between the body temperatures of hens taken once every four weeks and their winter and annual egg productions.

The results showed that the highest temperature was usually coincident with the peak of their production, but negative correlations were shown between the body temperature during the winter months and the winter egg production, varying from  $-0.1355 \pm 0.0105$  to  $-0.2502 \pm 0.0521$ . There was also a negative correlation between the average annual body temperature and the total number of eggs produced of  $-0.3391 \pm 0.0543$  in the Single Comb White Leghorns.

**Duration of life as an index of constitutional fitness**, R. PEARL (*Poultry Sci.*, 3 (1923), No. 1, pp. 1-10, figs. 4).—After briefly reviewing the results of the duration of life studies with *Drosophila* by Gonzales at the Johns Hopkins University (p. 824), the author suggests the importance of longevity as a factor indicating constitutional vigor in poultry. The breeding of the oldest hens available as a means of producing a vigorous strain having a low chick mortality and high productivity is suggested.

**A guide to culling for egg production**, N. HALL (*Missouri Poultry Sta. Bul.* 33 (1923), pp. 33, figs. 22).—Directions for culling the poultry flock in the selection of layers are given.

**Swat the rooster and market infertile summer eggs**, N. HALL (*Missouri Poultry Sta. Bul.* 32 (1923), pp. [15], figs. 7).—This bulletin advocates the production of infertile market eggs, largely because of their better keeping qualities, especially during the summer months.

**Egg production, monthly costs, and receipts on New Jersey poultry farms**, W. H. ALLEN (*New Jersey Stas., Hints to Poultrymen*, 12 (1924), No. 4, pp. 4).—A summary of the egg production, feed consumed, costs, and receipts on 20 poultry farms in New Jersey for the year ended October 31, 1923, is given. Similar results were reported for the previous year (*E. S. R.*, 48, p. 667).



**Fundamental facts relative to incubation and brooding**, T. W. NOLAND (*Missouri Poultry Sta. Bul.* 36 (1924), pp. 3-23, figs. 8).—This deals with the care and methods of selecting breeding stock and the principles to be observed when incubating eggs and breeding the chicks by natural and artificial means.

**Getting maximum results from the incubator**, W. P. THORP, JR. (*New Jersey Stas., Hints to Poultrymen*, 12 (1924), No. 5, pp. 4, fig. 1).—Practical instructions for running an incubator are given.

**Note on incubating eggs lying in water**, W. A. LIPPINCOTT and P. L. DE PUY (*Poultry Sci.*, 3 (1923), No. 1, pp. 25-28).—The effect of incubating eggs in trays containing 0.5 in. of water has been studied at the Kansas Experiment Station. To compare the results of incubation by this method, other eggs were varnished over an area equal to that covered by the water, and another lot was incubated in the usual way. Of the eggs incubated in water, 47.22 per cent of those fertile hatched, whereas 62.5 per cent of the varnished eggs and 50 per cent of the control eggs hatched. The average incubation temperature in each of these cases was 104.73° F. Two other lots of eggs incubated in water at slightly lower temperatures (102.33 and 102.60°) showed hatching percentages of 36.84 and 28.57 per cent. The eggs incubated in water were removed to a dry surface at the eighteenth day. Evidence to indicate that the water not only prevented evaporation, but also that some of the water was taken into the egg, was furnished by the losses in egg weight during this experiment, and in other experiments in which weak solutions of rhodamin red and methylene blue were added to the water and later found to be in the eggs.

**Capons for profit**, N. HALL (*Missouri Poultry Sta. Bul.* 34 (1923), pp. [3-17], figs. 15).—The advantages from caponizing cockerels are discussed, and directions are given as to when to caponize and how to care for the birds before and after the operation.

**Marketing poultry**, R. R. SLOCUM (*U. S. Dept. Agr., Farmers' Bul.* 1377 (1924), pp. II+30, figs. 22).—A discussion of the problems of poultry marketing from the standpoint of transportation, seasonal production, marketing channels, and shipping live poultry is given, as well as instructions for finishing, killing, dressing, and packing dressed poultry.

**Marketing eggs in Indiana**, A. G. PHILIPS (*Purdue Agr. Ext. Bul.* 120 (1923), pp. 16, figs. 10).—This deals especially with the methods of candling and grading eggs for market.

**Effect of ventilation on the keeping quality of eggs in cold storage**, M. E. PENNINGTON (*In Storage Investigations, 1921-1922 Canton, Pa.: Marble Lab., Inc.*, 1923, pp. 5-13).—A single experiment is reported in which the quality of June eggs kept four to five and seven months in storage rooms having different amounts of ventilation are compared. It was found that the losses due to evaporation were only slightly greater in ventilated rooms when a sufficiently high degree of humidity was maintained, and the eggs in the ventilated rooms did not absorb as much of the storage odors and did not tend to mold as badly as eggs held in nonventilated rooms. Ventilation tended to check the growth of mold which had already started in the cases in a nonventilated room.

## DAIRY FARMING—DAIRYING.

**Studies of dairy cattle.—II, Milk production**, J. J. HOOPER (*Kentucky Sta. Bul.* 248 (1923), pp. 65-85, figs. 4).—The results of four studies, based on 12 years' records of the station herd, are reported in continuation of the studies of dairy cattle previously noted (*E. S. R.*, 46, p. 372).

1. *Influence of the growing fetus on milk production* (pp. 65-70).—Twenty-four cows were bred on about the eightieth day after calving during one year



and on the two hundred and fifteenth day after calving in another year. In the former year they were milked an average of 311 days and produced 6,980 lbs. of milk, whereas in the second year they were in milk an average of 431 days and produced 8,120 lbs. of milk. A tabulation of the monthly milk produced by these groups of cows showed that those bred early in lactation began to show greater decreases in their milk flow beginning with the seventh month, whereas such decreases were not shown until after the tenth month with later breeding. It is assumed, based on the works of other authors, that the growing fetus secretes something which inhibits lactation.

2. *Influence of early and late abortions on milk production* (pp. 70-75).—The monthly milk records are given of 6 cows aborting from 103 to 183 days after service, of 6 cows aborting from 216 to 254 days after service, and of 6 cows which calved at full time. These records are given for the 7 months prior to the month of abortion and for 7 months after the month of abortion. A graph of the average production of the cows of the different groups shows very clearly that all records gradually declined until calving, after which there was a slight increase from an average of 516 to 524 lbs. of milk per month for the cows aborting earliest. The cows aborting later increased their monthly average milk production from 411 to 683, and the cows calving normally increased from 281 to 1,052 lbs.

3. *Influence of abortion of first calves on milk production* (pp. 75-78).—The milk records of 5 heifers aborting their calves from 215 to 261 days in pregnancy were similarly compared with the records of 5 heifers calving at normal time. The heifers aborting produced an average of 5,146 lbs. of milk in 10 months as compared with 5,432 lbs. produced by those calving normally. The heifers calving normally were also bred earlier.

4. *Influence of season of the year on the quantity and quality of milk produced* (pp. 79-85).—In studying the influence of the season of freshening on milk production, milk records of 22 winter freshening, 23 spring freshening, 20 summer freshening, and 23 fall freshening cows were compiled. The cows freshening in the winter gradually increased their production to May and declined through the summer and fall. The spring and summer freshening cows started off with the highest yields, but gradually declined. The fall freshening cows maintained a more uniform yield than those of any other group. The fat content of the cows freshening in the winter and spring was low during the spring, but was higher for the summer and fall freshening cows at this season.

A comparison of Jersey sires based on the average "mature equivalent" fat production of the daughters, C. W. TURNER and A. C. RAGSDALE (*Missouri Sta. Bul.* 206 (1923), pp. 12, figs. 2).—Jersey sires having 10 or more daughters in the Register of Merit are classified according to the average fat production of their daughters corrected according to age as in the previous studies (E. S. R., 49, p. 374).

The rate of growth of the dairy cow.—V, Extrauterine growth in linear dimensions, S. BRODY and A. C. RAGSDALE (*Jour. Gen. Physiol.*, 6 (1924), No. 3, pp. 329-336, figs. 4).—A study of the monthly measurements of the different parts of dairy cows during their first 60 months of age confirms the conclusion of the previous studies of this series relative to extrauterine growth (E. S. R., 50, p. 578), i. e., that growth follows the course of an equation expressing a monomolecular reaction provided sufficiently long intervals are taken to eliminate cyclic fluctuations.

Feeding dairy cows, A. C. RAGSDALE (*Missouri Sta. Circ.* 115 (1923), pp. 12, figs. 4).—The general principles of feeding dairy cows are described, with statements of nutrient requirements and methods of balancing rations.



**Winter rations for dairy heifers**, A. C. RAGSDALE (*Missouri Sta. Circ.* 116 (1923), pp. 8, figs. 7).—This is a popular discussion of different rations for wintering dairy heifers, based on the experiments by Eckles, previously noted (*E. S. R.*, 41, p. 77).

**Some analyses of mixtures of milk of goats and ewes**, H. KUFFERATH (*Ann. Gembloux*, 29 (1923), No. 7, pp. 210, 211).—The density and composition of samples of milk from goats and ewes are tabulated.

**Relation of acidity to butterfat content in milk and cream**, C. L. ROADHOUSE and L. V. TOWT (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 240-244, fig. 1).—In experiments at the California Experiment Station, samples of milk were so separated that the resulting products contained from a trace to about 50 per cent of fat, and there was found to be a decrease in the acidity of samples containing the different amounts of fat as the fat percentage increased. The average rate of change was found to be 0.00128 per cent of acidity for each per cent of increase in the fat. These results may be applied in a practical way by the use of the following formula:

$$x = a - [(c - m) \times 0.00128]$$

in which  $x$  = the acidity of the cream desired,  $a$  = the acidity of the milk,  $c$  = the percentage of fat in the cream, and  $m$  = the percentage of fat in the milk.

**Milk as a food for the Chinese**, T. P. SZE (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 346-353).—This is a discussion of the difficulties attending the production of cow's milk in China.

**The dairy industry in Czechoslovakia and conditions influencing it at the present time**, F. ROSINEK (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 123-125).—This is a brief description of dairying in Czechoslovakia. The milk is mainly produced by cows, though goats and sheep contribute a considerable portion.

**Twelfth annual report of the International Association of Dairy and Milk Inspectors** (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 371, figs. 8).—This is the usual report of the meeting of the association held in Washington, D. C., on September 28 and 29 and October 1, 1923. A list of the papers has been previously given (*E. S. R.*, 49, p. 698), and many of them have been individually abstracted elsewhere.

**Report of the committee on dairy methods, I-IV** (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 41-65).—The report of the committee of the association dealing with the methods and regulations for cooling milk is given in four parts.

I. *Milk cooling regulations from the standpoint of control agencies*, E. Kelly (pp. 41-49).—The replies of the health departments of 15 cities to 10 questions dealing with the temperature requirements for milk sold in each city are summarized. Though considerable variation was found in the different cases, the study indicates that the attempt is to have milk cooled below 50° F. in the future. Considerable difference of opinion was expressed as to the best time of taking the temperature of the milk.

II. *Cooling milk from the standpoint of the producers and the receiving station*, H. A. Harding (pp. 50-56).—The material given in this paper deals with the development of bacteria in milk and the necessity of producers cooling milk when it is not delivered to the receiving station in a relatively short time. The suggestions given are based largely on the germicidal action of milk as previously reported (*E. S. R.*, 45, p. 72) and from other studies carried on in the dairy department of the Illinois Experiment Station. The necessity of cooling night's milk when the milk is delivered to the receiving station only

once a day is emphasized, and different methods of cooling and keeping milk cool are discussed.

III. *Milk temperature and bacterial content of milk at time of delivery*, W. D. DOTTERER (pp. 57-60).—The relation between the bacterial counts and the temperature was determined in 890 samples of milk as delivered at a receiving station. The arrangement of the samples in groups according to their bacterial counts showed that as the count increased, the percentage having temperatures of 60° or under decreased. The counts of 73.2 per cent of the samples received under 60° were less than 2,000,000, whereas only 57.5 per cent of those delivered over 60° showed counts of less than 2,000,000 bacteria per cubic centimeter.

IV. *Present status of the milk cooling problem, summary and conclusions of the committee*, G. C. SUPPLEE (pp. 61-65).—In summarizing the work of the committee, the necessity of proper cooling was brought out and more rigid enforcement of health department regulations was recommended.

See also a previous note (E. S. R., 49, p. 698).

**A comprehensive system of dairy inspection**, J. J. FREY (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 220-230).—This deals with the problems involved in establishing and carrying on dairy inspection.

**What should an inspector look for at the farm as the cause of high count raw milk?** H. A. HARDING (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 245-251).—This is essentially an evaluation of the influence of the different operations in the dairy on the bacterial count of raw milk, based mainly on the results of studies previously reported from the Illinois Experiment Station.

**Report of committee on transportation of milk and milk products**, R. S. SMITH (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 106-109).—The author offers suggestions for milk producers, railroads, milk dealers and milk inspectors to aid in relieving the present transportation difficulties.

**What is the best type of milk ordinance?** L. C. FRANK (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 178-194).—The desired contents of a milk ordinance are discussed in some detail, showing how the regulations should be gradually made more strict as producers and dealers become more accustomed to the necessity of cleanliness in the production and handling of milk products.

**Fundamentals of a practical milk ordinance**, L. C. BULMER (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 262-271, figs. 6).—The fundamentals of a milk ordinance are discussed on the basis of experiences in Birmingham, Ala.

**The influence of efficient supervision on a municipal milk supply**, F. W. WRIGHT, A. I. VAN SAUN, and C. H. AMERMAN (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 76-84).—This is a review of the methods employed in improving the quality of the milk supply of New Haven, Conn. This was accomplished largely through the education of the dealers and the public and the publication of the bacterial counts of the milk sold.

**On the regulation for the control of the trade in cow's milk**, M. SATO (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 305-310).—This consists mainly of a copy of the laws governing the sale of cow's milk in Japan.

**Report of committee on milk plants**, C. E. CLEMENT (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 110-122).—The necessary considerations to be taken into account when erecting a milk plant are briefly discussed, as previously noted (E. S. R., 49, p. 699).



**A clean milk supply for a small town**, S. H. VANCE (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 231-239).—A review is given of the improvement which has been brought about in the quality of the milk supply of several small towns in Kentucky by the employment of a milk inspector. The quality of the milk was determined by bacterial counts and the *Bacillus coli* contamination. The condition of the dairies was also markedly improved as determined on the score card basis.

**Premiums with special reference to quality in a milk supply**, F. D. WALMSLEY (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 129-135).—An experiment in which premiums of 40 and 25 cts. per hundred-weight were offered for milk containing less than 10,000 and from 10,000 to 25,000 bacteria per cubic centimeter, respectively, was found to markedly improve the quality of the milk delivered at a receiving station. Before starting the experiment the producers were given detailed instructions on the methods tending to help in the production of clean milk through better care of utensils, proper methods of cooling, etc.

**Observations on the washing and sterilizing of milk bottles**, R. S. SMITH (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 278-293).—In studies of methods of bottle washing at different dairies by the U. S. D. A. Dairy Division, it was found that bottles washed in a mechanical bottle washer and steamer with caustic soda solution, hot water, and steam added an average of 66.8 bacteria per cubic centimeter to the milk, whereas bottles washed by hot water and rotary brushes added averages of 849.3 and 1,156 bacteria per cubic centimeter, when considering two different lots of dairies. The use of chlorin solutions for rinsing bottles after washing is also discussed. The use of cold water for rinsing was found to reduce the bacterial content per cubic centimeter of capacity from an average of 85.8 to 7.4 and at the same time lowered the temperature of the bottles. This method, however, necessitates additional expense, and it is suggested that holding in a cool room would often be more practical. None the less, some plants have found it advantageous to fill the bottles immediately after washing, as storing in an upright position has been found to increase the bacterial content of the bottles.

**Report of committee on methods of bacterial analysis of milk and milk products**, G. E. BOLLING (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 200-203).—A comparison of the bacterial counts of a large number of samples of milk made on different media at several laboratories has indicated that the more complicated media are liable to give more erratic results. Two types of powdered media are recommended for general use, i. e., that which is manufactured by the Digestive Ferments Co. and a similar product, the manufacture of which is contemplated by the research laboratory of the Dry Milk Co. of New York.

**The pin point colonies observed in the bacterial examination of milk, their resistance to heat and growth in different culture media**, J. W. YATES and J. J. GLOVER (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 252-261).—Difficulties with the occurrence of pin point colonies in plate counts of pasteurized milk have been found to be due to organisms which apparently develop very rapidly at pasteurization temperatures. This situation became very serious in certain Kansas City plants where continuous flow pasteurizers were used. Bacterial counts made on pre-war media were much lower than those made on bacto agar, indicating that such organisms, though probably present, were not discovered because of their inability to grow well on the pre-war media.



**Report of committee on pasteurization of milk and cream, W. H. PRICE** (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 136-144).—The works of a number of authors dealing with the efficiency of pasteurization in controlling the spread of contagious diseases when properly supervised are reviewed with the conclusion that no satisfactory substitute for pasteurization is known. A definition of pasteurization has been previously noted (E. S. R., 49, p. 699).

**The relationship between dairy and pathogenic streptococci: A further argument for pasteurization, A. C. EVANS** (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 215-219).—The presence and possible growth of *Streptococcus viridans* in milk is suggested as another reason for pasteurizing milk to be used in the manufacture of the different dairy products, the growth conditions necessary for this organism and *S. lacticus* being compared.

**Some observations on high counts in milk freshly pasteurized under commercial conditions, W. D. DOTERRER** (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 204-214).—Certain irregularities in the bacterial counts of milk pasteurized at a certain milk plant were studied by making counts of the milk from the individual farms before and after pasteurization. It was found that these irregularities were due to the milk from three farms which was of unusually high count and in which the efficiency of pasteurization was much lower than in the other milk samples. Further study of the conditions at these farms indicated that the trouble was due to poorly cleaned milking machines. The necessity for proper sterilization of all dairy utensils is thus emphasized.

**Milk tainting plants and some stored milk troubles, E. W. FENTON** (*Seale-Hayne Agr. Col. Pamphlet 11* (1923), pp. 8).—The off-flavors produced in milk by plants eaten by cattle are briefly summarized, as well as the production by bacteria of off-flavors, colors, or conditions such as ropy milk.

**The dangers from butter as a carrier of disease, E. C. SCHROEDER** (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 321-331).—The author describes experiments carried on by the Bureau of Animal Industry, U. S. D. A., in which 100-day-old butter made from the milk of tubercular cows was found to produce tuberculosis in hogs consuming it. The fat globules of milk tend to act as carriers for the bacteria and, therefore, cream contains about 60 per cent of the organisms present in the milk. The pasteurization of cream for butter making is recommended, with the labeling of butter so that the consumer may know whether it was made from pasteurized or raw cream.

**The correct sampling of ice cream, B. VENER** (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 12 (1923), pp. 195-199).—Ice cream should be sampled in the solid condition and from full cans which have not had an opportunity to melt and become refrozen. The necessity of proper agitation of the mix is suggested as an aid to uniformity. Homogenization and other similar processes tend to make the product more uniform.

## VETERINARY MEDICINE.

**Report of the Ontario Veterinary College, 1923** (*Ontario Vet. Col. Rpt. 1923*, pp. 60, figs. 3).—This report includes several appendixes, which deal, respectively, with damaged sweet clover, the cause of a new disease in cattle stimulating hemorrhagic septicemia and blackleg (pp. 21-34); purulent pneumonia in calves (p. 35); *Strongylus contortus* infection in lambs (p. 35); acute septicemia and pneumonia, the probable cause of losses occurring among young pigs (p. 36); necrotic stomatitis in suckling pigs (p. 37); nasal catarrh among fowl (p. 37); an examination of samples of milk (pp. 38, 39); the



agglutination test for infectious abortion (pp. 39-44); a modification of the complement fixation test for infectious abortion (pp. 44-50); the agglutination curve in guinea pigs in relation to the diagnosis of abortion disease (pp. 51-54); the abortion test in guinea pigs in relation to the differentiation of infected and immune animals (pp. 54-56); cultures other than *Bacterium abortus* agglutinated by anti-*B. abortus* serum (pp. 56-58); roup and canker experiments (pp. 58, 59); and chicken-pox vaccination experiment (pp. 59, 60).

The work with damaged sweet clover has led to the following conclusions: "(1) The disease investigated is a new disease and, while simulating hemorrhagic septicemia and blackleg, is entirely distinct from these diseases. (2) The disease is produced by a toxic substance which is present in moldy sweet clover. There is much evidence that certain molds are responsible for the formation of this poisonous principle. (3) The toxic substance produces the disease by destroying or damaging the cells of important tissues and vital organs. This may result in hemorrhage, delayed coagulation of the blood, and destruction of the red blood cells. (4) There is no evidence to show that the feeding of good sweet clover hay or silage can produce the disease in question. (5) The molding of the hay and silage can be greatly reduced by observing proper methods of sowing and harvesting the crop."

**Fifth biennial report of the Oregon State Livestock Sanitary Board for the period ending December 21, 1922**, W. K. TAYLOR and W. H. LYTLE (*Oreg. State Livestock Sanit. Bd. Bien. Rpt.*, 5 (1921-22), pp. 43).—This report includes an account of the occurrence of and work with infectious diseases of livestock in Oregon.

**Studies on bacterial nutrition.—V, The effect of plant tissue upon the growth of anaerobic bacilli**, O. T. AVERY and H. J. MORGAN (*Jour. Expt. Med.*, 39 (1924), No. 2, pp. 289-302, figs. 3).—Continuing the studies previously noted (*E. S. R.*, 50, p. 184) the effect was determined of heated and unheated potato upon the growth of five anaerobic organisms in broth under aerobic conditions.

With unheated tissue, *Bacterium pneumosintes* did not grow beyond the first subculture, but *Bacillus histolyticus*, *B. chauvæi*, *B. aerofetidis*, and *B. edematiens* grew through three successive subcultures. When boiled or autoclaved instead of unheated potato tissue was used, *Bacterium pneumosintes* again failed to grow. *Bacillus histolyticus* grew through three subcultures in broth containing boiled potato, but a larger seeding was required for the third subculture. In broth containing autoclaved potato a larger seeding was required for the second transfer, and no growth took place in the third. *B. chauvæi* grew through two transfers in broth containing boiled and only one in broth containing autoclaved potato. *B. aerofetidis* and *B. edematiens* grew more readily in broth containing autoclaved than boiled potato, but the growth was not so abundant as when the unheated tissue was used.

In discussing the significance of these results, the conclusion is drawn that "aerobic growth of anaerobic bacteria under the above conditions may be related to the presence of growth-accessory substances, and to the action of oxidizing-reducing systems of plant tissue in the destruction of toxic peroxids of bacterial origin."

**A new method of preparing vaccines**, R. ZIVY (*Lancet [London]*, 1924, I, No. 5, p. 221).—The author recommends as a method of killing bacteria for use as vaccines alternate freezing at  $-18^{\circ}$  C. and thawing at room temperature. The technique consists in making an emulsion in physiological salt solution of an agar culture of the organism and placing this in aluminum tubes in a freezing apparatus with a constant temperature of  $-18^{\circ}$ . The tubes are left in the freezing apparatus for 5 hours and then left another 5 hours at room temperature. It is stated that this operation must be repeated twice for



pneumococci and streptococci, four times for *Bacillus coli*, and six times for staphylococci and enterococci.

**The chemical nature of medicines and drugs**, L. SPIEGEL (*Heilmittel und Gifte im Lichte der Chemie*. Stuttgart: Ferdinand Enke, 1923, pp. VIII+131).—Following a brief introductory section in which various theories concerning the chemical and physiological action of drugs are discussed and a brief section on the action of inorganic compounds, the volume deals with the chemical constitution and physiological action of organic medicinal compounds alone or in combination with metals.

**On the migration of *Hypoderma lineatum* from the skin to the gullet**, S. HADWEN and J. S. FULTON (*Parasitology*, 16 (1924), No. 1, pp. 98-106, pl. 1).—Investigations conducted by the authors at the University of Saskatchewan, Canada, have led to the following conclusions:

"The condition of hypodermal rash or dermatitis may be mistaken for mange or cowpox. The warble larvae may reach the esophagus in the first stage, and in the Province of Saskatchewan, Canada, larvae have been found in the esophagus as early as June 21. On this date one larva measuring 2 mm. was found, and several 2.25 mm. in length. Twenty-one larvae collected under the submucosa averaged 3 mm. in length and nine larvae found outside the esophagus 3.2 mm. On July 7 the average length of the larvae was a little longer, 115 averaging 3.7 mm. The larvae in the thoracic cavity proved to be sterile. This was proved by removing larvae and incubating them in bouillon tubes. The eosinophile plays an active part in combating the entrance of *Hypoderma* larvae into the body and acts as a phagocyte in the presence of warble grubs. Animals become immune to warble grubs when they reach adult life. Following the experimental injection of warble juice into 10 calves, 7 of the animals were not affected, and 3 gave typical anaphylactic reactions. The 3 calves appeared to have an inherited sensitiveness to the injection of warble juice."

***Cysticercus tenuicollis*: Its incidence and immunological reactions**, T. D. BECKWITH and W. E. SCOTT (*Amer. Jour. Hyg.*, 4 (1924), No. 1, pp. 1-11).—This report of investigations, conducted by the department of bacteriology and experimental pathology of the University of California, has the following conclusions:

"*C. tenuicollis* is found chiefly on the omentum and mesentery of the host, rarely elsewhere. It is encountered more frequently in sheep and hogs than in other domesticated animals. A seasonal variation is found in the number and size of the parasites; they are encountered most frequently and are largest in the winter months. Many of the old cysts undergo suppuration and calcification. The *Cysticercus* is capable of independent motion, in that it exhibits peristaltic-like movements. Slaughterhouse inspection does not disclose effects of toxicity on the host from the parasite; moreover, intraperitoneal injections of the fluid into guinea pigs does not reveal any evidence of toxicity. The cyst fluid shows no microscopic evidence of infiltration of cells from the host, while osmotic experiments prove the inner cyst wall to be permeable to inorganic salts. A definite and characteristic white blood cell response follows the intraperitoneal injection of the cyst fluid into guinea pigs. This consists of leucopenia followed by leucocytosis. There is no definite eosinophilia. A positive precipitin reaction was obtained with the sera of less than 50 per cent of the immunized animals. Therefore this reaction, as applied to diagnosis of *C. tenuicollis* infestation, can not be considered reliable. The precipitin antibody is identical, whether the host be sheep or hog. Moreover, by the precipitin reaction it is indicated that the cyst fluid is elaborated by the parasite rather than by the host. Partial fixation of alexin was obtained in each



of three series. Whether or not complete fixation would occur with more intense immunization of the animals was not determined."

A bibliography of 27 titles is included.

**Microbial variations and anthrax infection**, A. GRATIA (*Compt. Rend. Soc. Biol. [Paris]*, 90 (1924), No. 5, pp. 369-371).—This is a further contribution to the question as to whether the skin alone, in the case of rabbits and guinea pigs, is sensitive to anthrax infection. The strain of anthrax bacilli employed by the author has the property of dissociating into two types. In bouillon cultures, one of these forms an agglutinated growth which settles to the bottom of the tube in large flakes, while the other grows diffusely. Examined under the microscope, the first consists of long filaments and the other of isolated cells of very short chains. On injecting the first type intravenously into rabbits, 11 out of 12 died in from 2 to 4 days of anthrax septicemia, while of 9 rabbits inoculated under similar conditions with the other type, 4 survived and 5 succumbed at intervals of from 7 days to one month. Only one of the fatalities in the latter case was proved to be due to anthrax.

These results are thought to confirm those of Bachmann et al. (*E. S. R.*, 50, p. 284) and of previous investigators that in the rabbit, at least, other organs than the skin are sensitive to anthrax.

**Australian anthrax vaccine** (*Vet. Rec.*, 3 (1923), No. 24, pp. 423-425).—This is a report to the Parliament of the Union of South Africa on the safety of the Australian anthrax vaccine and on the degree and duration of immunity secured by it.

**The present status of immunization against blackleg with germ-free filtrates**, H. ZELLER (*Berlin. Tierärztl. Wchnschr.*, 40 (1924), No. 5, pp. 49-51).—A brief review of recent literature.

**Experimental studies on the correctness of the French theory of the plurality of foot-and-mouth disease virus**, O. WALDMANN and K. MAYR (*Berlin. Tierärztl. Wchnschr.*, 40 (1924), No. 4, pp. 37, 38).—To test the theory of Vallée and Carré of the plurality of foot-and-mouth disease virus (*E. S. R.*, 49, p. 282), the authors conducted immunization experiments on guinea pigs with three strains of virus of German, Italian, and French origin.

In the first experiment 13 guinea pigs received injections of the German strain and developed the disease with generalized symptoms. After intervals of from 14 to 90 days they were given injections of the Italian virus but with no effect. Similar results were obtained when the first injection was of the Italian and the second of the German strain. Of 10 animals receiving the German virus first, followed by the French virus, only 2 showed signs of foot-and-mouth disease, while of 5 injected with the French virus, followed by the German, 1 only showed symptoms.

These results are thought to indicate that there is no essential difference in the different strains of virus employed, but that there is always to be expected a certain amount of individual variation in response to the virus.

**Bacteriological findings in abscesses following immunization against foot-and-mouth disease with sterile convalescent blood**, E. JANUSCHKE (*Arch. Wiss. u. Prakt. Tierheilk.*, 48 (1922), No. 5-6, pp. 304-312, figs. 3).—In the course of the immunization of cattle against foot-and-mouth disease with sterile blood from animals recovering from the disease, abscesses at the site of injection resulted in 4 out of 18 animals vaccinated at the same time. The bacteriological examination of these abscesses showed *Bacillus pyogenes* to be the predominant microorganism present. It is considered probable that the organism obtained access to the blood stream through the lesions of the mucous membrane of animals afflicted with the disease and tended to gather at the site of injection of the blood, forming spontaneous abscesses. It is recommended



that in the vaccination of animals which are already afflicted, the injections should be made in several places in amounts of not more than 50 to 60 cc. in one place. Animals which are well at the time of the vaccination can receive the blood in one place to the extent of about 250 cc.

[**Foot-and-mouth disease situation in Great Britain**], S. STOCKMAN (*Vet. Record*, 4 (1924), No. 3, pp. 35-39).—This is a statement made at a meeting of the council of the National Veterinary Medical Association on January 9 of the eradication work with foot-and-mouth disease in Great Britain.

**Theileriasis in goats, sheep, and cattle, with a description of *Theileria hirci* n. sp. from Serbia**, E. DSCHUNKOVSKY and V. URODSHEVICH (*Parasitology*, 16 (1924), No. 1, pp. 107-110, figs. 2).—The author's report upon an outbreak of this disease in Serbia, in which 46 per cent of the 39 goats affected succumbed. A description is given of *T. hirci*, the causative agent, which has been found to represent a new species. *Rhipicephalus bursa* was collected in different parts of Serbia from healthy or characteristically affected goats, and is thought to be the carrier of *T. hirci*.

**A comparative study of the virulence and toxicity of the microorganisms and tuberculin from various strains of tubercle bacilli.—Increase in virulence of attenuated strains. Attempts at vaccination**, A. BORREL, L. BOEZ, and A. DE COULON (*Ann. Inst. Pasteur*, 37 (1923), No. 12, pp. 1012-1033).—The authors have selected, from a study of 25 different strains of tubercle bacilli, data obtained on 12 strains including 6 human, 5 bovine, and 1 equine.

These strains varied in virulence, as determined by guinea pig inoculation. The strains that were the most attenuated were of bovine origin. The majority of the attenuated strains could be rendered virulent by animal passage, particularly by intracardial inoculation. Progressive attenuation of virulence was accompanied generally by a decrease in the toxicity of the corresponding tuberculin, but the relation between the two was not always constant. Certain almost avirulent strains continued to secrete a very active tuberculin.

Guinea pigs inoculated intracardially, intraperitoneally, and particularly subcutaneously with attenuated strains showed an appreciable resistance to tuberculinization. All of the animals thus inoculated succumbed, however, sooner or later with tuberculous lesions.

**Histopathologic conditions of granular vaginitis in bovis**, L. E. STARR (*Vet. Med.*, 19 (1924), No. 1, pp. 25-31, figs. 2).—It is pointed out that this is a very common disease of cattle, occurring in 90 to 95 per cent of the adult cattle in the United States.

"It is characterized by nodular protrusions of the vaginal mucosa, accompanied in the acute stage by hyperemia and congestion of the part and a mucopurulent discharge. Bacteriological examinations indicate that the causative agent is a streptococcus of the viridens type, which predominates as diplococci and short chains, six to nine organisms in the chains. The acuteness of the conditions is variable, its intensity being increased by any irritation, especially oestrus, coitis, or external influences, following which it subsides to some extent. The acute stage is followed by the chronic stage, during which the hyperemia disappears, the discharge ceases, and the nodules gradually become smaller, until in old animals the vaginal mucosa is normal on ordinary observations.

"Microscopic histological examinations of affected cows indicate that the nodules are proliferations of the lymph follicles as the result of the irritation from the toxins elaborated by the causative organisms. The nodules are situated in the subepithelium and consist of dense masses of proliferated lymphocytes, which infiltrate the contiguous tissues, involving in acute cases the papillae and epithelium. The mass of the nodules cause a protrusion of



the mucosa with elevation and thinning of the epithelium, which is worn off by attrition. Connective tissue proliferates in the nodules in chronic cases, causing diminution in their size and density. The nodular mass becomes encapsulated, the epithelium regenerates, and in time may become smooth and apparently normal on casual observation. The papillae are only affected indirectly. Papulles or vesicles were not observed at any stage. The cows in time develop sufficient immunity against the organisms to inhibit their growth, thus preventing the further irritation and consequent nodular formation. This accounts for the low visibility of the nodules in aged cows."

**Proteinuria in newborn calves following the feeding of colostrum,** T. SMITH and R. B. LITTLE (*Jour. Expt. Med.*, 39 (1924), No. 2, pp. 303-312).—Evidence is presented that the feeding of colostrum to calves results in the appearance of protein in the urine during the first three days of life, but that under normal conditions this permeability of the kidneys disappears after this time. The urine of fetuses, unfed calves, and calves fed milk instead of colostrum did not contain excess protein.

**The relation between the ingestion of colostrum or blood serum and the appearance of globulin and albumin in the blood and urine of the newborn calf,** P. E. HOWE (*Jour. Expt. Med.*, 39 (1924), No. 2, pp. 313-320).—In connection with the above study, analyses were made of the proteins in the blood and in the urine of the calves under investigation.

It was found that "in every uncomplicated case in which protein has appeared in the urine of newborn calves following the ingestion of colostrum, euglobulin and pseudoglobulin I have appeared in the blood. When colostrum has been withheld from a calf for some hours after birth the globulin fractions have not appeared in the blood in appreciable amounts and no protein has appeared in the urine, but upon the subsequent ingestion of colostrum these proteins have appeared in the blood and urine. The proteins in the urine consist of the euglobulin, pseudoglobulin I and II, and albumin fractions."

These results are thought to furnish further evidence that proteinuria in the newborn calf is due to ingestion of colostrum.

**Castration of hogs,** S. S. BUCKLEY (*U. S. Dept. Agr., Farmers' Bul.* 1357 (1923), pp. II+8, figs. 9).—This is a practical account, superseding Farmers' Bulletin 780 (*E. S. R.*, 36, p. 482).

**Recent progress in the study and control of hog cholera,** UHLENHUTH (*Deut. Med. Wechnschr.*, 49 (1923), No. 21, pp. 667-669).—A brief discussion of recent investigations.

**A study of the serology, the cerebrospinal fluid, and the pathological changes in the spinal cord in dourine,** H. W. SCHOENING and R. J. FORMAD (*Jour. Agr. Research [U. S.]*, 26 (1923), No. 10, pp. 497-505, figs. 4).—The subject of this study at the Bureau of Animal Industry, U. S. D. A., was a stallion which had given a positive complement fixation reaction for dourine in 1913 and had been kept under observation from that time until its death in 1921, following symptoms of affection of the central nervous system. During the period of observation the animal gave no clinical evidence of dourine. It was bred several times to a native mare to determine whether the infection could be transmitted. About a year from the time of the first service the mare aborted and died shortly after, but gave no indication of dourine other than evidence of muscular weakness. The complement fixation test was negative.

The complement fixation test was applied to the serum of the stallion at various times during the eight years in which the animal was under observation. The antigen used was a suspension of *Trypanosoma equiperdum* recovered from the blood of artificially infected rats by the method of Reynolds and Schoening, previously noted (*E. S. R.*, 40, p. 85). The serum at no time

gave a 4+ reaction with a quantity lower than 0.06 cc., and toward the end of the time a 4+ was not obtained even with quantities of 0.2 cc.

Previous to the post-mortem examination, the spinal fluid was obtained and subjected to various tests. The colloidal gold test by the method of Reynolds and Schoening (E. S. R., 47, p. 684) gave positive results, while the spinal fluid of three calves dead of artificial blackleg gave negative results. The Ross-Jones test for globulin, consisting in the white or gray ring at the point of contact of a saturated solution of ammonium sulphate and the spinal fluid, was also positive for the stallion and negative for the calves. An average of three counts of the spinal fluid gave 180 cells per cubic millimeter for the stallion, while none were observed in the calves. The complement fixation test with the inactivated spinal fluid of the stallion gave a 4+ reaction in amounts as low as 0.05 cc., but was negative with the calves.

The gross post-mortem examination showed gelatinous infiltration in the subcutaneous tissue and the abdominal muscles and a normal penis, thoracic organs, liver, kidney, and intestines. The left testicle was atrophied to about half the normal size, and its glandular substance was soft and flabby. The right testicle was normal. The spleen showed areas of hemorrhagic infarction, and there was a gelatinous infiltration in the dorsal and lumbar portion of the spinal canal. The microscopic changes in the spinal cord were not particularly pronounced. Slight changes in the nerve tissues are described under three headings, vascular changes, neuroglial changes, and degenerative changes.

**Blood pressure and its application in canine practice**, J. G. HORNING and G. B. KIRKWOOD (*Vet. Med.*, 19 (1924), No. 1, pp. 36-38, figs. 3).—This discussion of hypertension and hypotension includes a table which shows the blood pressure in various breeds of dogs in some of the diseases to which dogs are susceptible.

**Bacillus acidophilus and immune serum in bacillary white diarrhea of chicks**, G. E. JORGENSEN (*North Amer. Vet.*, 5 (1924), No. 2, pp. 63-65).—The experiments reported were based on the well known effect of *B. acidophilus* in changing the bacterial flora of the intestinal tract. It was thought that the feeding of *B. acidophilus* milk to chickens exposed to, or already infected with, *B. pullorum* might have a favorable effect in preventing or curing bacillary white diarrhea.

Ten chicks ill with the disease and 4 healthy half-day-old chicks were fed 10 cc. each of *B. acidophilus* milk every 4 hours or 4 times a day, while 2 well and 2 sick birds did not receive the treatment. Of the 10 treated clinical cases only 3 died, while the 2 controls both died. Of the 4 treated well birds none died, although 1 had a slight attack of the disease, while both of the untreated controls developed the disease.

A second series of experiments was carried out on 10 healthy half-day-old chicks. Each was given two 5 cc. doses of acidophilus milk and 2 hours later 0.01 cc. of a virulent culture of *B. pullorum*. They were then placed in the infected brooder and had access to oatmeal and acidophilus milk. Only 1 of these birds contracted the disease, and it recovered.

In a third series of experiments the serum of 2 rabbits which had been immunized with cultures of *B. pullorum* was fed to 7 chicks with bacillary white diarrhea and to 4 well chicks which had been exposed to the infection. The serum was given with a pipette in 5-cc. doses twice a day. Of the 7 sick birds, 5 recovered, and none of the healthy chicks developed the disease.

**Diseases of chicks**, S. ERIKSEN (*Missouri Poultry Sta. Bul.* 36 (1924), pp. 24-33, figs. 3).—This is a popular account dealing with the diseases to which chicks are subject and means for their control.



**Blackhead in turkeys**, H. WELCH (*Montana Sta. Circ. 117* (1923), pp. 7, figs. 3).—A brief summary of information on this disease of turkeys.

**Disease in captive wild mammals and birds: Incidence, description, comparison**, H. FOX (*Philadelphia and London: J. B. Lippincott Co., 1923, pp. 111+665, pls. 91, figs. 31*).—In a foreword to this work, by C. B. Penrose (pp. 1-16), it is stated that the work on which the book is based was begun in November, 1901, from which date systematic autopsies were made and records kept of animals dying in the Philadelphia Zoological Garden. Following an introduction (pp. 17-47), the subject is dealt with under the headings of diseases of the heart (pp. 48-65), blood vessels (pp. 66-82), blood and bone marrow (pp. 83-113), lymphatic tissues including spleen (pp. 114-133), the respiratory system and its related structures (pp. 134-165), the alimentary tract (pp. 166-262), the urinary tract (pp. 263-286), the female reproductive organs (pp. 287-312), the male genitalia (pp. 313-315), the ductless glands (pp. 316-342), the skeleton and its joints (pp. 343-371), and of the central nervous system and the special senses (pp. 372-409), constitutional diseases (pp. 410-414), and neoplasms (pp. 462-482), and infectious diseases (pp. 483-613). The relation of diet to disease is dealt with by E. P. Corson-White (pp. 415-461) and the animal parasites, their incidence and significance, by F. D. Weidman (pp. 614-659).

## RURAL ENGINEERING.

**International critical tables of numerical data of physics, chemistry, and technology** (Washington, D. C.: Natl. Research Council, [1924], pp. 15).—Tables of fundamental constants and conversion factors, prepared under the auspices of the International Research Council, are given.

**When is water safe for irrigation purposes?** A. J. PERKINS (*Jour. Dept. A. So. Aust., 27* (1923), No. 5, pp. 443-454).—Analyses of well waters used for irrigation in South Australia are presented and discussed.

The results indicate that under Adelaide conditions, with winter and spring rains aggregating from 14 to 15 in., irrigation water containing as much as 140 grains of injurious salts per gallon may be used for fruit trees and vegetables, with the exception of citrus trees and French beans, provided natural drainage conditions are satisfactory. Under similar conditions citrus trees and French beans may be safely grown with water containing from 75 to 80 grains of injurious salts per gallon. While irrigation waters containing more than 140 grains of harmful salts per gallon have not been analyzed, it is considered probable that around Adelaide waters containing even 200 grains of salts per gallon will not prove disastrous to plants other than citrus trees and French beans, provided drainage conditions are perfect.

**Use of machinery in ditch digging and experiments in drainage ditching and reclamation**, O. FREDHOLM (*Meddel. K. Lantbr. Styr. [Sweden], No. 248* (1924), pp. 94, figs. 74).—Observations on machine ditching in large-scale drainage operations made during a tour of the United States, England, Germany, and the Netherlands in the year 1922 are presented, and types of ditching machines adapted to Swedish conditions are enumerated. The advantage of electric power for the operation of ditching machines is emphasized. Internal-combustion engine driven machines gave better results than steam engine driven machines owing to the ease of handling and storage of the fuel, but repairs were more difficult to make.

**Engineering and legal aspects of land drainage in Illinois**, G. W. PICKELS and F. B. LEONARD, JR. (*Ill. State Geol. Survey Bul. 42* (1921), pp. 322, pl. 1).—This report consists of four parts. Part 1 deals with the status of drainage in the State in 1920, part 2 outlines the engineering problems, and part 3 the



legal problems involved, and part 4 discusses State aid on different drainage districts in the State.

**Drainage district assessments: A study of present practices in assessing benefits under the State drainage laws,** G. R. BOYD and R. A. HART (*U. S. Dept. Agr. Bul. 1207 (1924), pp. 70*).—The established principles of drainage assessments and present practices in assessing benefits under drainage laws of different States are presented.

A special assessment is defined as a burden laid upon real estate to secure a special benefit to such property and a general benefit to the public at large. General benefits are defined as those which are enjoyed by the public at large and which are common to all the people of the community. The factors of special benefit generally include (1) the need of drainage or wetness of the land, (2) the amount of drainage or protection furnished, (3) increased healthfulness, (4) increased accessibility, and (5) the use which is being made of the property.

The three general methods of determining the assessments in use are the percentage, classification, and the actual-value-of-the-benefits methods. The first two methods are said to be either too complicated or too inflexible to allow the fixing of equitable assessments. The third method, which estimates the actual value of the benefits conferred and apportions the assessments accordingly, is required by the statutes of about 14 States. It follows directly the theory of special benefits by determining the value of the benefits to accrue and uses the benefits as the basis for apportioning the assessments. It is considered to be much better than any other method now in use, and in addition is simple and readily understood. The use of this method is strongly recommended.

**The economics of highway grades,** T. R. AGG (*Iowa Engin. Expt. Sta. Bul. 65 (1923), pp. 48, figs. 37*).—A tentative economic theory of highway grades is presented, which is based upon the analyses of a great amount of data bearing on the subject and extensive field investigations which have been in progress for three years.

The results indicate that where the annual traffic may reach several million tons the actual value of the fuel saved by grade reduction may reach very significant sums. The value of lost time due to excessive grades is an even larger sum, especially where the volume of commercial vehicle traffic is large.

It has apparently been established that momentum grades on rural highways are economical both from the standpoint of fuel and time, and that under certain circumstances less fuel will be required on a road with an undulating grade line than on one with very flat grades. It is also shown that no economy results from the reduction of long grades of less than about 3 per cent, and that short grades may reach 8 per cent without adversely affecting either fuel consumption or average speed. An interesting fact brought out in the fuel consumption tests was the marked saving in fuel that results from coasting downhill with the motor declutched.

**Roughness as a factor in pavement life,** A. T. GOLDBECK (*Engin. and Contract., Roads and Streets, 61 (1924), No. 2, pp. 306-316, figs. 12*).—In a contribution from the U. S. D. A. Bureau of Public Roads, the causes and effects of road roughness are discussed in connection with measurements of impact on surfaces and of the effect of impact on stress in concrete roads. Devices for measuring roughness are described. The results so far obtained indicate in general that even a seemingly smooth road surface will have appreciable roughness, and that the higher the speed the greater and the more frequent will be the impacts delivered to the surface by trucks. The rougher the road the greater are the impacts.



**Road construction in Peru**, W. E. DUNN (*U. S. Dept. Com., Bur. Foreign and Dom. Com. Trade Inform. Bul. 198 (1924), pp. 11+16*).—General information on road construction in Peru is presented, including data on location, specifications, construction, and maintenance costs, and road-making equipment. A list of roads passable for automobiles in the Republic is included.

**Relative durability of native woods** (*U. S. Dept. Agr., Forest Serv., Forest Prod. Lab. Tech. Note 173 [1922], pp. 2; also in Engin. and Contract., Buildings, 61 (1924), No. 1, p. 203*).—Tabular data are presented on the relative durability or resistance to decay of untreated woods.

**Exposure tests on colorless waterproofing materials**, D. W. KESSLER (*U. S. Dept. Com. Bur. Standards Technol. Paper 248 (1924), pp. 33, pls. 3, figs. 10*).—This paper describes the nature of several colorless waterproofing materials and presents the results of physical tests on the various treatments to determine their relative effectiveness and durability. The greater number of the materials tested consisted of paraffin, china-wood oil, aluminum soap, and resinous materials dissolved in light mineral solvents. These were applied to the surfaces of such porous materials as limestone and sandstone in order to render them impervious to moisture. The dissolved matter is carried into the pores of the surface, and as the solvents evaporate a considerable portion of the solid matter remains in the stone, which tends to fill or seal the pores.

The most effective waterproofing materials were found to be those, the waterproofing elements of which are heavy petroleum distillates, fatty oils, or insoluble soaps. It was found that the effectiveness of any waterproofing may be greatly influenced by the character of the pores in the stone, those having close textures being more difficult to waterproof than those with large pores. The treatments giving the highest waterproofing values and which appeared to be the most durable were those using paraffin as the waterproofing element either alone or in conjunction with other materials. The deterioration or loss of waterproofing value on materials of this type was not appreciable within a period of two years.

Materials employing resinous substances as the waterproofing element were not durable, and materials consisting of aqueous solutions, the purpose of which is to react chemically with stone or to act merely as water repellents, had only temporary effects. Separate aqueous solutions which react chemically with each other and form insoluble substances in the pores of the stone gave low waterproofing values and deteriorated rapidly. In general, those materials which gave the highest waterproofing values produced the greatest discolorations, which were proportional to the porosities of the stones. These discolorations decreased on exposure to the weather.

**Economic motor-fuel volatility**, R. BIRDSSELL (*Jour. Soc. Automotive Engin., 14 (1924), No. 3, pp. 267-273, figs. 9*).—In a further contribution to the subject by the U. S. Bureau of Standards (*E. S. R., 49, p. 887*), progress data on the fuel investigation, including results obtained from acceleration tests made on the road and in the laboratory, are reported. The tests described were conducted primarily to determine whether the rates of acceleration obtainable at any given temperature are different for fuels of high and low volatility and whether, when carburetor settings are such as to give maximum acceleration with each fuel, the fuel consumption under constant speed and load conditions will be greater with one fuel than with the other.

Under all conditions very nearly the same rate of acceleration was obtained with the fuel of low volatility as with that of high volatility, but under cold conditions more of the former fuel was required for maximum acceleration than of the latter. Maximum acceleration occurred at the carburetor setting



giving the maximum power at 600 r. p. m. and full throttle. The tendency was also noted for the acceleration to become greater as the temperatures were decreased. This was due largely to the greater power developed under these conditions, and did not imply better fuel utilization. There was an appreciable lag in the acceleration with a lean setting. With a rich setting the engine showed a greater initial acceleration, but for the full range of the engine speed the greatest average acceleration was obtained with the maximum power setting.

Data on the design of the disk used to simulate the inertia of an automotive vehicle are appended.

**Stresses in a few welded and riveted tanks tested under hydrostatic pressure**, A. H. STANG and T. W. GREENE (*U. S. Dept. Com., Bur. Standards Technol. Paper 243 (1923), pp. 645-666, pls. 3, figs. 7*).—Studies to determine the relative merits of riveted and electric welded tanks are reported, in which four steel tanks 4 ft. in diameter and 10 ft. long, made of  $\frac{5}{16}$ -in. mild steel plates, were tested under hydrostatic pressure. Two of the tanks were butt welded, one was lap welded, and the fourth was of the ordinary lap riveted construction. The ends of the tanks were spherical with a 4-ft. radius.

The results of the hydrostatic tests proved rather unsatisfactory for comparing the relative strengths of the different types because of secondary failures. For thin tanks the measured stresses, based upon the two dimensional formulas for longitudinal as well as transverse stress in the tanks, were found to be in close agreement with the design stresses computed by the common pressure formulas, provided the former are not affected by secondary causes. Secondary stresses, which resulted in high stress intensity and produced failure in each case, were caused by faulty design of the attachment of the spherical end to the cylindrical shell, by nonconformity of the shell to an accurate circular section, and by discontinuities in the shell for the manhole and fittings. Stresses were increased by the presence of a seam.

Poor welding and calking were responsible for the premature failures of two of the tanks. It is concluded that with more careful workmanship these tanks can be made, having a factor of safety of two or more, for a working stress of 16,000 lbs. per square inch in the plate.

**The fool-proof poultry house** (*Missouri Poultry Sta. Bul. 35 (1923), pp. 50, figs. 31*).—So-called fool-proof poultry houses designed for Missouri conditions are described and illustrated, and working drawings and bills of materials are included.

**Open-air range house**, F. L. KNOWLTON (*Oregon Sta. Circ. 54 (1924), pp. 3, pl. 1, fig. 1*).—Drawings and a bill of materials for an open-air range house adapted for Oregon conditions are presented.

**Imhoff tank and sprinkling filter studies at Plainfield Works**, W. RUDOLFS (*Abs. in Engin. News-Rec., 90 (1923), No. 18, pp. 779-781*).—The progress results of studies conducted by the New Jersey Experiment Stations in cooperation with the New Jersey State Board of Health on the chemical changes in sewage and on the sewage flora and fauna are reported.

It has been found that very few fungi and algae occur in the Imhoff tank. The protozoa apparently increase in number with increasing depth, and as a rule the scum formed in the vents of the tank does not contain protozoa at all. It is noted that the numbers of flagellates and ciliates in the influent are ordinarily the same as those in the effluent.

The data show further that the more abundant bacteria in Imhoff tanks are those which attack the most easily digested protein material. These bacteria were always present even in the highest dilutions used, and their numbers apparently bore some relation to the character of the protein molecule.



This seemed to be indicated by the fact that bacteria which produce sulphids from soluble proteins are less prevalent than bacteria which produce ammonia from the same substances. It is noted that nitrogen is oxidized to the nitrate form, while at the same time organisms are present which reduce nitrates to nitrites and finally to ammonia. This latter group was found to be in ascendance in the Imhoff tank. In addition to the groups of bacteria mentioned other organisms were found which included (1) bacteria producing sulphids from inorganic sulphates, (2) bacteria oxidizing thiosulphate to free sulphur and sulphates, (3) bacteria which digest cellulose, and (4) bacteria which split fats.

Reaction studies showed that in nearly every case the scum in an Imhoff tank is decidedly less alkaline than the influent, and in nearly all cases less alkaline than the preliminary sludge, ranging in reaction from pH 6.8 to 7.6. Bacterial action was found to cause considerable production of carbon dioxid. At the same time the sulphur organisms producing hydrogen sulphid and the sulphates present or produced by bacteria cause a reduction of alkalinity of the material. This is taken to indicate the reason why the liquid layer is usually slightly less alkaline or sometimes neutral as compared with the influent. Foaming is considered to be the result of gas production, and while organisms producing large quantities of gas may be beneficial they can be the cause of the poor operation of a tank. The total absence of oxygen and hydrogen in Imhoff tanks is considered especially noteworthy.

Studies on sprinkling filters showed that the slimy film which accumulates on the stones of sprinkling filter beds plays a very important part in the purification of the sewage which passes through the filter. This film is composed largely of a host of bacteria, a great variety of microscopic animals, and occasionally an abundance of fungi. The film on the surface is characterized by the great predominance of algae, which are not present in great variety but are extremely abundant in quantity. As the fungi disappear there are increasing amounts of filamentous bacteria and protozoa which help to hold the film together. It is emphasized that it is the living aggregate of associated organisms constituting the film rather than any simple type of creature which is significant for the purification of the sewage. It is noted that nitrification increases rapidly after sloughing, and that when the film around the stones becomes thicker nitrification decreases. With the disappearance of protozoa in the natural film nitrification improves.

## RURAL ECONOMICS AND SOCIOLOGY.

**A study of farm organization in southwestern Minnesota, G. A. POND and J. W. TAPP (*Minnesota Sta. Bul. 205 (1923), pp. 9-135, figs. 30*).—**A study conducted in Cottonwood and Jackson Counties, Minn., cooperatively by the station and the Bureau of Agricultural Economics, U. S. D. A., is summarized here. Data with regard to the amounts and distribution of labor and materials used in the production of the different crops and classes of livestock on the farms contributing data and of the miscellaneous work incident to the operation of the farms were secured by the complete cost route method on 24 farms in the vicinity of Windom, beginning in March, 1920, and continuing into 1922. Altogether 65 complete farm records were obtained, 36 different farms being included.

Part 1 of the discussion gives an account of the development of the agriculture of the area from the time of settlement.

Part 2 is a detailed statement and analysis of the data. The wide variations in the amount of labor put on crops, together with the variations in the amount



of feed used in the production of livestock and livestock products by individual farmers, are brought out. The speed and efficiency with which field operations can be performed are said to depend upon the size and type of the implement and the power unit, the size and shape of fields, the intensity of cultivation, the condition of the soil or crop upon which the work is being done, the practice followed in performing the operations, and the managerial ability of the operator. It is noted that the miscellaneous man and horse labor about the farm may consume too much of the available labor or may not be applied properly. On 22 farms under study the miscellaneous work consumed from 5.2 to 25.1 per cent of the total man labor expended and from 2 to 15.9 per cent of the total horse labor.

Part 3 sets forth the principles underlying the proper combination of enterprises and their adjustment to changing economic conditions and to local conditions on particular farms. Illustrations are given of methods of making the choice and adjustment of enterprises. Two reorganization plans are presented for a typical farm. In the first plan, the acreage of oats, barley, and rye is reduced, while that of corn and hay is increased. With the same yields of crops and livestock a new financial balance is struck, indicating increased net returns equal to \$202 for the farm year. The influence of price changes on the choice between beef and dairy cattle is brought out by example. A second plan indicates that by renting additional land and expanding his production this farmer's net income could be increased by \$690 without hiring any additional labor except during corn husking. The second plan is intended to show the effect of increased livestock production on the income as well as that of shifts and expansion in production.

**The one-man ten-acre poultry demonstration farm, T. W. NOLAND** (*Missouri Poultry Sta. Bul.* 31 [1922], pp. 33, pl. 1, figs. 17).—This farm is operated along practical commercial lines as a demonstration of the location, buildings, equipment, strains, and feeding practices, which contribute to financial success in an enterprise of this size. Bills of material for the houses are given.

**The labor expenditure and the livestock kept on peasant farms in the Province of Brandenburg, FENSCH** (*Landw. Jahrb.*, 59 (1923), No. 1, pp. 127-147).—Data were collected in 1922 from over 1,000 farm businesses in 18 regions of Brandenburg. Returns showing the labor expended and the livestock kept on farms in numerous size groups having average soil and an average proportion of land in pasture or grass are tabulated.

**Security of tenure for allotment holders, E. L. MITCHELL** (*Jour. Min. Agr. [Gt. Brit.]*, 30 (1923), No. 8, pp. 726-732).—Examples of cooperative effort are described, illustrating a variety of detail in the schemes for land purchase for allotments in England.

**Foreign labor in German agriculture and the question of substituting for it, G. GROSS** (*Landw. Jahrb.*, 59 (1923), No. 1, pp. 1-63).—The adoption of intensive agricultural methods in Germany and especially the introduction of potatoes and sugar beets is shown to have caused an increased labor demand. The efforts of the German Central Labor Office to license foreign workers are set forth. The need for transient labor, which had been largely recruited from neighboring States, was met during the war to a considerable extent by the employment of prisoners of war. War conditions and the German revolution resulted in a loss of laborers, although not all of the prisoners and foreigners returned to their homes. State intervention became necessary, and farm labor committees were established.

Various regulations which were promulgated in 1921 and 1922 are set forth in detail. Housing provisions in regions where sugar beets and potatoes are the predominating crop and the effect of housing on the permanency of



the labor supply are described, and a study is made of the foreign and seasonal labor used according to the size of holding and type of farming. Recommendations are made with reference to the licensing procedure which should be put into practice and the means which would encourage the establishment of urban workers in the rural districts.

**Annual report of the Winnipeg Grain Exchange, 1922** (*Winnipeg Grain Exch. Ann. Rpt. 14* (1922), pp. 14+60-181).—This report presents current information in continuation of that previously noted (E. S. R., 47, p. 94).

**Emergency commission to promote a permanent system of self-supporting agriculture** (*U. S. Senate, 68. Cong., 1. Sess., Com. Agr. and Forestry, Hearings on S. 1597, 1924, pp. II+206, figs. 4*).—Statements, submitted by the presidents of agricultural colleges in the Northwest and by practical farmers and others in hearings held in January, 1924, on a Senate bill to provide for an emergency commission to promote a permanent system of self-supporting agriculture in regions adversely affected by the stimulation of wheat production during the war and aggravated by many years of small yields and high production costs of wheat, are published here. They pertain to the economic and financial position of the wheat farmer in the Northwest.

**A large estate in Egypt in the third century B. C.**, M. ROSTOVTZEFF (*Wis. Univ. Studies Social Sci. and Hist. No. 6* (1922), pp. X+209, pls. 3).—Greek papyri recently discovered at Kharabet el Gerza in the Fayum are described and interpreted in this study. They consisted largely of letters from the archives of one Zenon, a Carian Greek and an agent of Apollonius, the manager of economic affairs for King Ptolemy II Philadelphus. An account is given of the career of this man who, after having been business manager for Apollonius, later went to the Fayum to take complete charge of the latter's large estate at Philadelphia. A detailed investigation of the documents reveals the nature of his activities as local public administrator, collector of taxes and assessments, official in charge of the maintenance of dikes and canals, and manager of crops, vineyards, orchards, and livestock enterprises.

This study is said to furnish a key to the position of Greeks in Egypt at this period and the attitude of the Ptolemies toward them and especially toward the settlement of the Greek or half-Greek mercenary soldiery of the Ptolemaic armies on the land. The village of Philadelphia is known to have been one of those which were founded under the second Ptolemy as the result of his work of drainage and irrigation in the marshes and sandy land on the shores of Lake Moeris.

**Agriculture and dairying in the world's economic equilibrium**, B. M. ANDERSON, JR. (*Econ. World, n. ser., 26* (1923), No. 15, pp. 508-510).—This is an address delivered before the World's Dairy Congress, noted editorially (E. S. R., 49, p. 604).

Statistics of exports and imports of dairy products and the gross value of farm products are presented and interpreted to show that the gross value of dairy products in agriculture is very large and is a source of current cash income. It is considered that within certain limits, set principally by the labor situation, an expansion of the dairy industry and the further development of a home demand for dairy products are advisable.

**The elements of nontechnical rural economy**, É VLIBERGH (*Éléments d'Économie Rurale Non-technique. [Louvain]: Bocrenbond Belge, 1922, pp. XXII+575*).—A treatise is presented in which economic, social, legal, and political phases of agriculture are discussed, with particular reference to conditions in Belgium and neighboring countries before 1914. These questions are treated in four sections dealing with the arable land in Belgium and the



manner in which it is operated, the peasant farmer, the agricultural laborer, and intervention by the State, the province, and the community in favor of agriculture, livestock, and related industries.

**The town v. the countryside**, S. L. BENSUSAN (*London: P. S. King & Son, Ltd., 1923, pp. 23*).—The case is presented for the need of harmony among landlords, farmers, and farm workers in Great Britain and of concerted action to insure an adequate, independent food supply for the nation.

**Agriculture and the situation of agricultural laborers in Finland** (*L'Agriculture et la Situation des Ouvriers Agricoles en Finlande. Helsingfors: Min. Affaires Sociales Finlande, 1923, pp. 55, pl. 1, figs. 14*).—An interpretation of statistical information is offered here, covering the conditions of agriculture in Finland, the occupational constitution of the population, the size of agricultural holdings, agricultural production, cooperatives, the classes and condition, working hours and wages of workers, and housing provisions.

**Ireland: Its agricultural, industrial, and commercial resources**, F. A. CHRISTOPH (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform. Bul. 188 (1924), pp. II+44*).—Several pages of this report are devoted to the subject of agriculture, setting forth briefly the area under cultivation and crop production in Ireland, factors influencing Irish farming, the number of small and medium sized farms, dairying, the livestock industry, bacon curing in the Irish Free State and in Northern Ireland, and agricultural cooperation.

**The rural economy of Japan**, D. H. BUCHANAN (*Quart. Jour. Econ., 37 (1923), No. 4, pp. 545-578*).—This article covers briefly the agricultural resources of Japan, the extent of ownership and tenancy, the highly intensive cultivation practiced, rural incomes and standards of living, social conditions, and the relations of landlords and tenants.

**The social aspects of rural life and farm tenantry in Cedar County, Iowa**, G. H. VON TUNGELN, E. L. KIRKPATRICK, C. R. HOFFER, and J. F. THADEN (*Iowa Sta. Bul. 217 (1923), pp. 433-494, figs. 19*).—A detailed study was made in the summer of 1920 covering 400 farms and farm families in the northwest corner of Cedar County, Iowa, including four townships and part of the fifth, exclusive of the incorporated towns of Stanwood and Mechanicsville, the station and the Bureau of Agricultural Economics, U. S. D. A., cooperating. An analysis was made of the population and of the economic, educational, religious, and social conditions found on these farms and among these farm families.

As a whole, this is a predominantly native American community. Of the 188 owner operators, 17 have farms of 320 acres or more, although most of the farms include between 100 and 260 acres. Two hundred and thirty-seven or 59.2 per cent of the farms are operated by owners and "owners additional" (owner operators of rented land in addition to their own).

With reference to the education of the farmers, it was found that 73 per cent of 391 farmers quit school in the grades, 23 per cent in high school, and 4 per cent in college. Of 354 farmers' wives, 62 per cent quit school in the grades, 33 per cent in high school, and 5 per cent in college. The towns of Stanwood and Mechanicsville each afford a consolidated school, and there is another at Tipton attended by all the pupils from Red Oak township whose homes are not included in the Stanwood district. There are ten 1-room schools in the area and one centralized school made up of four rural schools.

The outstanding feature of the religious life in the area is the work of four churches under the direction of a minister in Red Oak Grove and his staff. These form an experiment and demonstration field fostered jointly by the local communities and the Presbyterian Church Board as a means of determining what can be done through the rural church in farming communities



under the direction of a well-trained, understanding, and sympathetic leadership.

Information is given in detail with reference to the distances to schools, trading centers, and churches; membership in organizations, chiefly lodges; health conditions; conditions of the home and farmstead; the work of farm women outside of the house; hired labor; and the interrelation and interdependence of the trade centers and open country surrounding them.

**A social study of Ravalli County, Mont.,** W. H. BAUMGARTEL (*Montana Sta. Bul.* 160 (1923), pp. 32, figs. 17).—This is the first of a series of studies in rural community organization which is being carried on by the station and the Bureau of Agricultural Economics, U. S. D. A. The three parts of the bulletin present, respectively, the physical features and a brief history of the county; an account of institutions, such as the school districts and voting precincts which are county-wide in scope; and deductions and suggestions which may assist in promoting the efficiency of the various institutions and in correlating them with effective community organization.

**A thousand farm homes in Nebraska,** J. O. RANKIN (*Jour. Rural Ed.*, 3 (1923), No. 4, pp. 155-162; 3 (1924), No. 5, pp. 217-225).—This address before the Sixth Annual Conference of the American Country Life Association, 1923, is based upon survey data noted earlier (*E. S. R.*, 49, p. 595; 50, p. 290).

**Proceedings of the Fifth National Country Life Conference** (*Natl. Country Life Conf. Proc.*, 5 (1922), pp. VII+212, pls. 2).—This conference at Columbia University in 1922 was devoted to the topic of country community education. The papers embodied in this report are as follows: President's Address: The Education of the Rural People, by K. L. Butterfield; Handicaps of the Rural Child, by O. G. Brim; Removing the Handicaps of the Rural Child, by L. L. Driver; National Responsibilities for the Improvement of Rural Education, by W. C. Bagley; The Public School a Center for Rural Community Education, by R. Root; Economic Education of the Farmer, by A. Sapiro; The Rural Press as an Educational Agency, by C. C. Taylor (*E. S. R.*, 48, p. 792); Principles and Achievements in Adult Education under the Smith-Lever Act, by C. B. Smith; Social Education of the Farm Population, by J. L. Gillin; Progress in the Study of Rural Social Problems, by C. J. Galpin; City and Country, by J. B. Reynolds; National Prosperity and Country Life, by S. L. Cromwell; Rural India, by D. Swamidoss; The International Country Life Movement, by K. L. Butterfield; The Educational Function of the Country Church, by P. L. Vogt; Symposium: Educational Programs of Ethical and Religious Organizations in Country Communities—For the National Catholic Welfare Council by A. C. Monahan, Religious Education in the Rural Church School by E. deS. Brunner (*E. S. R.*, 50, p. 794), The Young Women's Christian Association and Rural Communities by H. Roelofs, For Jewish Women on the Farms by A. Greenwald, How Y. M. C. A. Work Stimulates Educational Programs for Rural Communities by G. C. Hendry, and Scouting as an Ethical and Religious Program by G. J. Fisher; Rural Municipalities of Tomorrow, by R. S. Childs; The Rural Social Sciences and Rural Community Progress, by B. L. Melvin; The Professional Training of Rural Leaders, by E. L. Morgan; Developing Rural Leadership through Play and Recreation, by J. F. Smith; The Educational Value of Improved Means of Communication, by J. M. Gillette; The Educational Values of Democratic Community Organizations, by N. T. Frame; Present Status and Tendencies in Rural Community Organization, by W. Burr; and International Institute of Agriculture, Rome, Italy, by C. B. Ware. The appendix contains a brief note with regard to the educational needs of the American farm woman, by F. E. Ward.



[Annual report of the Jewish Agricultural Society, Inc., for the year **1923**], G. DAVIDSON (*Jewish Agr. Soc. Ann. Rpt. 1923*, pp. 59).—This continues the series of reports previously noted (E. S. R., 48, p. 891).

**Cooperative marketing by small producers** (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), No. 9, pp. 838-844*).—Suggestions are made as to the study of the market, collection and delivery, methods of sale, and ways and means for marketing on the part of associations of producers. Note is made by way of illustration of the beginnings and progress of a marketing society formed by the women's institute at Criccieth, Wales.

**Report of the Central Union of Agricultural Cooperative Societies of Prague, 1922** (*Výroč. Zpr. Ústřední Jednoty Hospodář. Družstev Praze (Compt. Rend. Union Cent. Coop. Agr. Prague), 1922, pp. 79*).—A progress and financial report is given with tabulated statistics for a period of years. Summaries are given in English, French, and German.

**The cooperative movement in India**, P. MUKHERJI (*Calcutta: Thacker, Spink & Co., 1923, 3. ed., rev. and enl., pp. [1]+a—p+468+LXXX*).—A general review of cooperative credit societies and a survey of the beginnings of cooperation in India and particularly of agricultural credit societies are given. Various types of organizations are described in detail. The text is given of the Cooperative Societies Act of 1912. Appendixes present statistics and special reports, and a selected bibliography is added.

**Crops and Markets** (*U. S. Dept. Agr., Crops and Markets, 1 (1924), Nos. 5, pp. 65-80; 6, pp. 81-96; 7, pp. 97-112; 8, pp. 113-128, fig. 1*).—Current abstracts of market information, notes on the position in the market of important classes of agricultural commodities, tabulations of the weekly receipts and prices with summaries and comparisons, and brief notes presenting outstanding features of the market situation are presented in these numbers. Miscellaneous foreign crops and market notes are included.

**Monthly Supplement to Crops and Markets** (*U. S. Dept. Agr., Crops and Markets, 1 (1924), Sup. 2, pp. 41-80, figs. 4*).—This number is devoted largely to statistics of numbers and prices of livestock and livestock products, presenting tabulated reports on the number and value of livestock on farms in January, 1922-1924, by States, also monthly farm prices, 1910-1924, of 13 commodities, most of which are livestock or livestock products; a report of the livestock and meat situation, December, 1923; receipts and disposition of livestock at public stockyards for January; and cold storage holdings as of February 1.

The current farm price tables, beginning with January 15, 1924, present estimates of prices on the fifteenth of each month. Numerous fluid and prepared milk reports, statistics of carload shipments of fruits and vegetables, grain and seed receipts and stocks, and other information are given. Recent conferences on grain and cotton reports are briefly noted.

[**Statistics of agriculture in the South**] (*In Blue Book of Southern Progress, 1923. Baltimore: Manfrs. Rec., 1923, pp. 65-97*).—Statistics have been compiled showing the extent and value of farm property and the production and value of farm crops in the Southern States in recent years, with comparisons.

**Wisconsin agricultural statistics for 1921.—Annual crop and livestock review**, J. A. BECKER (*Wis. Dept. Agr. Bul. 48 [1922], pp. 72, fig. 1*).—This annual report supplements the one previously noted (E. S. R., 46, p. 695) by adding statistics for the later year.

**The census of Brazil of September 1, 1920.—III, Agriculture**, B. CARVALHOZ (*Recenseamento do Brazil Realizado em 1 de Setembro de 1920.—III, Agricultura. Rio de Janeiro: Min. Agr., Indus. e Com., Dir. Geral Estatist., 1923, pp. LXXXVII+512, pls. 26*).—This report with tabulated census statistics



shows the total area and the area and value of farm property, the classification and nationality of proprietors, systems of rural improvement, and the livestock on farms in Brazil, as of 1920.

[**Synopses of agricultural statistics for Chile, 1919 to 1921**] (*Ofic. Cent. Estadis., Sinópsis Estadis. Chile*, 1919, pp. 76-91; 1920, pp. 76-91; 1921, pp. 76-91).—These sections of annual reports present briefs of agricultural and livestock statistics.

[**Agricultural statistics for Belgium**] (*Ann. Statis. Belg. et Congo Belge*, 47 (1923), pp. 171-177).—Statistics are continued along the lines previously noted (*E. S. R.*, 48, p. 495) by adding data for 1920 and 1921.

**The Austrian food supply problem**, A. DURIG ET AL. (*Das Österreichische Ernährungsproblem. Vienna: Bundesmin. Volksernähr.*, 1921, pt. 1, pp. [1]+207, figs. 6; 1922, pts. 2, pp. 209-285, figs. 3; 3, pp. 287-504, fig. 1; 4, pp. 505-646, fig. 1).—An attempt is made to present a compilation of the available statistical material from official sources and special official inquiries for this purpose with reference to the problems of food production in the former Austro-Hungarian Monarchy, its component States, and especially old Austria before and during the war, as well as for the Republic of Austria up to the end of 1920. Chapters are devoted specifically to grain, legumes, livestock and meat animals, feeding stuffs, sugar, beer and malt, alcohol and yeast, fats, eggs, fish, potatoes, fruit and vegetables, and salt.

**Annual report of agricultural statistics [for Esthonia]**, A. PULLERITS (*Eesti Riik. Statis., Eesti Põllum. Statis. Aastar.* (*Ann. Statis. Agr. Estonie*), 1 (1923), pp. XVI+273, figs. 15).—Sections of this official annual report present statistics of area, landholding and agrarian reform, the area cultivated, crop conditions and yields, fertilizers used, and numbers of livestock, together with information with regard to livestock diseases, the function of the abattoirs, cooperative dairies and other societies, wages of agricultural laborers, and the price of agricultural products and livestock in Esthonia, principally for the years 1921 and 1922.

## AGRICULTURAL EDUCATION.

**Proceedings of the thirty-seventh annual convention of the Association of Land-Grant Colleges** (*Assoc. Land-Grant Cols. Proc.*, 37 (1923), pp. 494).—The usual lists, committee reports, and minutes of sessions are embodied in this volume of proceedings of the convention at Chicago, Ill., November 13-15, 1923, which has been discussed editorially (*E. S. R.*, 49, p. 701). A selected list of references on scientific and technical writing, prepared by M. L. Gericke, is presented. The following are the addresses and papers: Matter, Man, and the Morning Star, by H. Edwards; The Farm Home, by H. Work; Fundamental or Guiding Principles of Classroom Instruction, by F. M. McMurry; Appreciation of the Work of Dr. A. C. True, by H. Edwards; The Department and the Colleges, by H. C. Wallace; The Contribution of Land-grant Colleges to Liberal Culture, by A. R. Hill; Engineering Education in the Land-grant Colleges, by W. M. Riggs; The Purnell Bill, by F. S. Purnell; The Content of a Liberal Education, by D. S. Kimball; The American University Union, by G. E. McLean; Correlation of Educational Forces, by C. R. Mann; The Reserve Officers' Training Corps, by R. I. Rees; address of E. Davenport; address of W. O. Thompson; The International Institute of Agriculture, by F. B. Mumford; How Shall We Determine the Curriculum Best Suited to Meet the Needs of Agricultural Students? by A. Vivian; Opportunity of Administrators to Influence Class Instruction, by F. M. McMurry; The Status of Vocational Teacher Training in Land-grant Colleges, by C. H.



Lane; The Role of Economics in the Training of Agricultural Students, by B. H. Hibbard; Economics in the Agricultural Course, by H. C. Taylor; The Relation of Farmers' Organizations to Agricultural Colleges, by O. E. Bradfute; Relation of the Agricultural College to Agricultural Organizations, by R. A. Pearson; The Development of an Informational Service for Experiment Stations, by A. W. Hopkins and F. B. Linfield; Experiment Station Problems in the Utilization of Uncultivated Lands, by S. B. Doten and C. A. Willson; Regional Conventions and Regional Cooperation in Projects of Experiment Station Workers, by D. T. Gray and J. G. Lipman; The Administration of Agricultural Research, by E. W. Allen; The Place of the Junior Demonstrator in the Extension Program, by C. G. Burr and M. E. Sheridan; Local Leadership—Its Discovery, Training, and Functioning in Communities, by D. S. Myer and J. S. McKimmon; Some Unsolved Problems in Extension Work, by A. C. True; Factors to be Considered in Development of a State Program of Agricultural Improvement from the Economic Standpoint, by F. W. Peck; Factors to be Considered in the Development of a State Program of Agricultural Improvement from the Sociological Standpoint, by C. E. Lively; Correlating the Forces of the Agricultural Colleges in Carrying Out a Program of Agricultural Improvement, by A. R. Mann; The University and the Engineer, by F. J. Anderson; Cooperation of Land-grant Colleges in Highway Research, by A. Marston; Freshman Week at University of Maine, by H. S. Boardman; Impressions of Technical Colleges and Universities in Great Britain, by R. L. Sackett; Educational Waste, by F. H. Sibley; A Study of the Discard, by J. W. Votey; What Answer Shall the Engineering College Make to the New Demands Made of Its Graduates? by R. L. Wales; Personnel Work as Applied to a College of Engineering, by A. A. Potter; The Amount and Nature of Shop Work, by F. C. Bolton; Financial Problems in Home Economics, by M. L. Matthews; Organization Problems in Home Economics, by E. P. Chace; Internal Home Economics Relationships, by A. L. Marlatt; Problems of Research in Home Economics, by L. Stanley; and Home Economics Extension Work, by F. M. Thurston.

**Addresses and proceedings of the sixty-first annual meeting of the National Education Association, held at Oakland-San Francisco, Calif., July 1-6, 1923** (*Natl. Ed. Assoc. U. S. Addresses and Proc.*, 61 (1923), pp. XII+1068, figs. 17).—This volume embodies the proceedings of the general sessions, reports of committees, and addresses before both the Cleveland and San Francisco meetings of the National Council of Education as well as of the numerous departments of the National Education Association, and gives lists of officers and committees, reports of business sessions, and other matters.

**Criteria for a State program for the preparation of agricultural teachers**, C. E. MYERS (*Vocat. Ed. Mag.*, 2 (1924), No. 6, pp. 446-449).—The first part of this paper deals with the results of a questionnaire upon the organization of the institutions offering courses in agricultural education, which was sent to 25 deans of agricultural colleges and 25 deans of colleges of education. A rather general agreement as to the training of agricultural teachers jointly by the agricultural college and the college of education was found. The vote was definitely in favor of the college of education designating the courses required for certification. It seemed to be agreed also that the instructors offering professionalized courses should be jointly employed and hold seats in both faculties. The only question not receiving a decisive vote was as to whether or not the college of education should subsidize the agricultural departments carrying instructors offering professionalized courses.

In the second part of his paper the author is concerned with the setting up of criteria for the training of agricultural teachers as these criteria may affect



curriculum, certification, college teachers, and the organization and administration of college departments.

**"Professionalized subject-matter courses,"** S. DICKINSON (*Vocat. Ed. Mag.*, 2 (1924), No. 6, pp. 450-454).—This is a discussion of the above paper, confined particularly to the proposals regarding the curriculum, especially in connection with the so-called "professionalized subject-matter courses." Three propositions are defended, namely, that there should be no differentiation of subject-matter courses for those teachers who are preparing to teach, that the use of proper methods of teaching by the instructor in collegiate subject-matter should be emphasized, and that the prospective teacher should be prepared in methods directly in two courses: Special methods of teaching agriculture in the high school and practice teaching.

Further discussion of the same paper is contributed by L. E. Cook and T. H. Eaton.

**Curriculum construction,** W. W. CHARTERS (*New York: Macmillan Co.*, 1923, pp. XII+352).—The aim of this volume is the collection and interpretation of pioneer studies and that whole body of knowledge which has been derived as a result of criticisms of existing curriculum from the functional point of view. It is attempted to determine, analyze, and arrange in the order of their relative importance the ideals and activities which constitute the major objectives of education. The project as curriculum content is discussed in detail, the term project being used in the sense of a problematic act carried to completion in its natural setting.

A number of studies in specific school subjects which have been conducted in the effort to determine functionally the proper curriculum content are cited and discussed. One chapter is devoted to such studies as have been made in the field of vocational education. An unpublished study of the construction of a project curriculum in sheep husbandry by J. H. Greene is presented.

**A State policy in extension teaching** (*N. Y. Agr. Col. (Cornell) Ann. Rpt.*, 36 (1923), pp. 62-65).—The memorandum of understanding concerning extension activities between the New York State Department of Education and the State schools of agriculture and the State College of Agriculture and county farm and home bureau associations in counties in which State schools are located is given in full. After declaring that the State should not enter upon the policy of attaching extension specialists to the separate State schools of agriculture, it provides for participation on the part of such schools by their resident teachers in the extension activities of the counties adjacent to the schools and links these schools much more intimately and helpfully with the extension organization and program than they have been linked hitherto.

**Science remaking the world**, edited by O. W. CALDWELL and E. E. SLOSSON (*Garden City, N. Y.: Doubleday, Page & Co.*, 1923, pp. XII+292, pls. 16, figs. 14).—This volume is composed of 16 lectures constituting a course in Teachers College, Columbia University, presented during the summer of 1922. They are especially designed to assist the teachers in courses of general science or the special sciences by bringing textbooks up to date and suggesting possible occupations to young people. The lectures are as follows: Achievements and Obligations of Modern Science, and Louis Pasteur and Lengthened Human Life, both by O. W. Caldwell; Gasoline as a World Power, and The Influence of Coal Tar on Civilization, both by E. E. Slosson; Electrons and How We Use Them, by J. Mills; An Investigation on Epidemic Influenza, by P. K. Olitsky and F. L. Gates; Our Present Knowledge of Tuberculosis, by L. R. Williams; International Public Health, by G. E. Vincent; Educational Value of Modern Botanical Gardens, by G. T. Moore; The Meaning of Evolution, by J. M. Coulter; Our Fight Against Insects, by L. O. Howard; Insect Sociology, by V.

Kellogg; How the Forests Feed the Clouds, by R. Zon; The Modern Potato Problem, by C. O. Appleman; Chemistry and Economy of Food, by H. C. Sherman; and Our Daily Bread and Vitamins, by W. H. Eddy.

**Job lesson units for selected truck and fruit crops adapted to southern conditions**, F. A. MERRILL (*Fed. Bd. Vocat. Ed. Bul. 91 (1924), pp. VII+58*).—The suggestions to teachers for organizing instruction on the basis of job analyses of crop production presented in these pages have been prepared with the needs of teachers in part-time schools and of teacher trainers specifically in mind. The crops treated are those adapted to the southern climate and to southern farming conditions. Only such crops have been included for study as are of some commercial importance to southern truck and fruit growers. Sources of information are listed, and suggestions are made concerning methods of procedure both in the schoolroom and in the field. Illustrative material to be used in presenting the subject is noted.

**The dietary of health and disease**, G. I. THOMAS (*Philadelphia: Lea & Febiger, 1923, pp. XVIII+17-210, pls. 2, figs. 5*).—This is a textbook on food chemistry and food preparation for use in schools of nursing and departments of home economics.

**Farm accounting**, E. L. CURRIER, N. J. LENNES, and A. S. MERRILL (*New York: Macmillan Co., 1924, pp. IX+287, figs. 3*).—A text for an introductory course in farm accounting in high schools or agricultural colleges is presented in five parts covering inventory and financial statement, financial accounts, cost accounting, special problems and special records, and laboratory work in cost accounting, respectively. Exercises, topics for discussion, and projects are abundantly suggested.

### MISCELLANEOUS.

**Thirty-sixth Annual Report of Maryland Station, 1923**, H. J. PATTERSON (*Maryland Sta. Rpt. 1923, pp. XXII+88, figs. 12*).—This contains the organization list, a report by the director on the work and publications of the station, a financial statement for the fiscal year ended June 30, 1923, and reprints of Bulletins 251-255, previously noted.

**The research activities: The agricultural experiment station at Ithaca**, A. R. MANN (*N. Y. Agr. Col. (Cornell) Ann. Rpt., 36 (1923), pp. 29-46*).—These pages apparently constitute the thirty-sixth annual report of the station, including a summary of its work and publications.

**The preparation of reports**, R. P. BAKER (*New York: Ronald Press Co., 1924, pp. XV+468, figs. 30*).—This volume has been prepared to meet the need for a systematic analysis of the principles underlying the preparation of reports along engineering, scientific, and administrative lines, and is designed primarily for use in colleges of engineering, architecture, mining, agriculture, forestry, and business administration. Four of the twenty chapters deal specifically with experimental research reports, and a fifth with theoretical and descriptive research reports. The book is prepared particularly from the point of view of engineering, drawing most of its illustrations and examples from that field, but is of general application along the lines indicated.



## NOTES.

---

**Alabama College.**—Arvey Carnes has been appointed assistant professor of agricultural engineering.

**Alaska Stations.**—J. C. Wingfield, instructor in horticulture in the Kansas College, has been appointed assistant in charge at Matanuska.

**California University and Station.**—The fruit products laboratory and the dairy industry division of the station have recently cooperated in experiments on the use of fruits in the manufacture of ice cream. The studies thus far completed indicate that, while fresh fruit is unsatisfactory since the fruit and ice cream become so homogenized that the flavor of the fruit is concealed by the cream flavor, the strawberry, raspberry, and loganberry are marked exceptions. At least 5 per cent by weight of fruit is found necessary for a satisfactory flavor. The more highly the fruit could be impregnated with sugar without destroying its flavor, the more satisfactory were the results obtained, and fruit juices containing sugar were preferred to concentrated juices without sugar. Among the flavors found especially promising were those of concentrated Isabella grape juice, pomegranate juice, and apple juice.

Elwood Mead, professor of rural institutions, has been appointed commissioner of the Bureau of Reclamation, U. S. Department of the Interior.

**Illinois University.**—Dr. Alexander D. MacGillivray, professor of systematic entomology and an authority on insect morphology, the classification of the Coccidae and the Tenthredinoidea, and the immature stages of insects, died March 24 at the age of 55 years. Dr. MacGillivray was a native of Ohio and a graduate of Cornell University, receiving the Ph. D. degree in 1904. He was engaged in entomological work at Cornell from 1900 to 1911, becoming assistant professor of systematic entomology at the University of Illinois in the latter year, associate professor in 1913, and professor in 1917. He was a fellow of the Entomological Society of America, as well as its vice president in 1911 and its secretary-treasurer from 1911 to 1916, and a member of several other scientific bodies.

**Iowa College.**—A new livestock judging pavilion is to be erected for use next fall. A new cattle barn is also to be constructed.

**Massachusetts College.**—President Kenyon L. Butterfield has tendered his resignation, effective September 1, to accept the presidency of the Michigan College. John Phelan, director of short courses and since 1915 head of the department of rural sociology, has resigned in order to accompany President Butterfield as assistant to the president and head of the department of rural education.

Fayette H. Branch has been appointed extension professor of farm management vice A. F. MacDougal, who has become manager of the Middlesex County Farm Bureau.

**Missouri University and Station.**—O. C. McBride, instructor in entomology and deputy State nursery inspector, has resigned to become assistant en-

tomologist in the Minnesota Station. C. L. Davis has been appointed deputy nursery inspector for the station.

**Montana College and Station.**—Arthur H. Post has been appointed assistant professor of agronomy and assistant agronomist, beginning May 1.

**New York State Station.**—F. G. Mundiger, instructor in forest entomology at Syracuse University, has been appointed assistant in research (entomology), effective June 1.

**Ohio State University.**—A new agricultural engineering building is under construction and it is hoped will be ready for occupancy at the beginning of the winter quarter. It is a two-story, fireproof structure, containing among other features a turntable elevator, a laboratory for women, and a windmill deck at the top of the building. Facilities for 250 people will be provided in one room, and if larger quarters are desired the turntable which serves as a platform for speakers may be reversed, a steel curtain raised, and a room with a capacity of 600 will be available.

**West Virginia University and Station.**—E. A. Livesay, professor of animal husbandry and animal husbandman, and H. O. Henderson, associate professor of dairy husbandry and associate dairy husbandman, have been granted a year's leave of absence for graduate study, the former at the Bussey Institution and the latter at the University of Minnesota.

**Ontario Agricultural College.**—The semicentennial of the opening of the college was observed during the week of June 9. The anniversary exercises included addresses by the Minister of Agriculture, the president of the college and two former presidents, and several others. The annual meetings of the Canadian Society of Technical Agriculturists, the Canadian Seed Growers' Association, and the Ontario Agricultural and Experimental Union were held at the college in connection with the celebration. A feature of the society's program was the presentation of a series of advanced lectures by specialists from Canada and the United States on horticulture, field crops, animal industry, and economics.

**Second World's Poultry Congress.**—This congress was opened May 2 at Barcelona by the King of Spain and closed at Madrid May 19. Delegates were present from Argentina, Australia, Belgium, Brazil, Canada, Chile, China, Colombia, Cuba, Czechoslovakia, Denmark, Ecuador, Egypt, England, France, India, Italy, Mexico, the Netherlands, New Zealand, Peru, Poland, Rumania, Russia, Scotland, South Africa, the Straits Settlements, Switzerland, the United States, and Uruguay. Efforts are being made to hold the third congress in the United States in 1927.

**Eunice Rockwood Oberly Memorial Prize for Agricultural Bibliographies.**—The American Library Association announces the establishment of a prize in memory of Miss Eunice R. Oberly, formerly librarian of the Bureau of Plant Industry, U. S. Department of Agriculture. This prize is to be awarded to residents of the United States at two-year intervals for the best original bibliography in the field of agriculture or the natural sciences. The first competition will close December 1, 1924, at which time contributions must be in the hands of the chairman of the Memorial Fund Committee, Miss C. R. Barnett, librarian of the Department, from whom additional information as to the conditions may be obtained.

---

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM  
THE SUPERINTENDENT OF DOCUMENTS  
GOVERNMENT PRINTING OFFICE  
WASHINGTON, D. C.

AT

15 CENTS PER COPY



- Hartmann, M., 252.  
 Hartwell, B. L., 35, 520.  
 Hartwell, G. A., 169.  
 Hartzell, A., 154.  
 Harvey, E. M., 299, 741.  
 Harvey, R. B., 125, 126.  
 Harvey, W. F., 282, 680, 681.  
 Harvey, W. N., 28.  
 Haselhoff, E., 623.  
 Hasenbäumer, J., 17, 18.  
 Haskell, R. J., 146.  
 Haskell, S. B., 137, 696.  
 Hatch, S. R., 1.  
 Hatch, W. H., 1.  
 Hatch (Mrs.), W. H., 1.  
 Hathcock, B. D., 386.  
 Hausman, L. A., 289.  
 Hawes, A. F., 544.  
 Hawkins, L. A., 644.  
 Hay, R. D., 545.  
 Hayden, C. C., 175, 367, 468.  
 Hayes, F. M., 497.  
 Hayes, H. K., 143, 229, 732.  
 Hayes, J. F., 829.  
 Hayne, T. B., 559, 758.  
 Haynes, E., 682.  
 Hays, F. A., 72, 577.  
 Hazlett, H. L., 194.  
 Headlee, T. J., 254.  
 Heath, F. M., 837.  
 Hedgcock, G. G., 753.  
 Hedges, C. C., 196.  
 Heide, B. H., 96.  
 Heikinheimo, O., 838.  
 Heimann, H., 514.  
 Heinicke, A. J., 36, 299.  
 Heinly, H., 251.  
 Helfert, P., 574.  
 Heller, V. G., 768.  
 Helm, C. A., 799.  
 Helmer, R. H., 339, 471.  
 Hendel, J., 438.  
 Henderson, B., 591.  
 Henderson, E. W., 467, 577.  
 Henderson, H. O., 73, 900.  
 Henderson, W. F., 505.  
 Hendrick, J., 418.  
 Hendry, D., 231.  
 Hendry, G. C., 893.  
 Hennepe, B. J. C. te, 82.  
 Henricksen, H. C., 539.  
 Henry, A. J., 116, 415, 808.  
 Henry, H. H., 740.  
 Henry, M., 480.  
 Henson, E. R., 597.  
 Herbert, F. B., 659.  
 Herbert, P. A., 444.  
 Herles, F., 833.  
 Herman, R. S., 500.  
 Herms, W. B., 838, 845.  
 Hernais, P., 638.  
 Hernandez, A., 733, 829.  
 Hernandez, J., 116.  
 Herold, W., 255.  
 Herrick, C. A., 372.  
 Herrick, G. W., 661.  
 Hertig, M., 156, 561.  
 Hertwig, P., 128.  
 Hervey, G. E. R., 844.  
 Hervey, G. W., 72, 779.  
 Hess, A. F., 165.  
 Hess, A. H., 796.  
 Hesse, A. J., 253.  
 Hetzel, F. V., 189.  
 Hewes, L. I., 484, 586.  
 Hewett, E. A., 182.  
 Hewitt, J. A., 765.  
 Hewlett, K., 479.  
 Hibbard, B. H., 199, 896.  
 Hibbard, P. L., 214.  
 Hibbert, H., 206.  
 Hibshman, E. K., 237.  
 Hickernell, L. M., 257.  
 Hicks, W. H., 375, 469, 470, 471.  
 Hidinger, L. L., 99.  
 Hinton, T. E., 697.  
 Hilbert, H., 323.  
 Hildebrand, S. F., 709.  
 Hilgendorf, F. W., 237.  
 Hilgers, 590.  
 Hill, A. R., 895.  
 Hill, C. C., 58, 158.  
 Hill, E. B., 496.  
 Hillman, F. H., 739.  
 Hills, J. L., 324, 367.  
 Hind, R. R., 324.  
 Hindhede, M., 164.  
 Hinds, J. H., 296.  
 Hinds, W. E., 396.  
 Hinegardner, W. S., 308.  
 Hinton, F. B., 271.  
 Hiscock, I. V., 64.  
 Hissink, D. J., 16, 118.  
 Hitchcock, A. S., 735.  
 Hitchcock, F. L., 709.  
 Hite, B. C., 740.  
 Hite, B. H., 124.  
 Hitier, H., 794.  
 Hitier, J., 794.  
 Hixon, R. M., 627.  
 Hoagland, D. R., 221, 813, 821.  
 Hoagland, R., 859.  
 Hoare, C. A., 357.  
 Hoc, P., 322.  
 Hockey, J. F., 354, 751.  
 Hodgson, R. E., 120.  
 Hodson, E. A., 593.  
 Hodson, R. E., 133.  
 Hodson, R. W., 239.  
 Hoek, P. van, 193.  
 Hoerner, G. R., 548, 746.  
 Hoet, J., 264.  
 Hoffer, C. R., 892.  
 Hoffman, A. H., 189.  
 Hoffman, C. T., 164.  
 Hoffman, I. C., 300.  
 Hoffman, W. F., 125.  
 Hoffmann, R., 122.  
 Hofman, J. V., 743, 807, 808.  
 Hogan, A. G., 268, 466, 467.  
 Hogan, P., 394.  
 Hogben, L. T., 500.  
 Hogentogler, C. A., 386.  
 Hogg, R., 573.  
 Holben, F. J., 422.  
 Hollinger, A. H., 257.  
 Holm, G. E., 204, 713.  
 Holman, W. L., 79.  
 Holmer, M. R. N., 356.  
 Holmes, A. D., 365, 664, 665, 804, 858.  
 Holmes, C. L., 91.  
 Holmes, L. C., 497.  
 Holmes-Pegler, H. S., 670.  
 Holt, L. E., 669.  
 Holt, S. V., 418.  
 Holt, W. L., 486.  
 Honcamp, F., 218, 677, 721.  
 Honeycutt, A. J., 391.  
 Honeywell, H. E., 867.  
 Hood, E. G., 788.  
 Hooker, H. D., jr., 836.  
 Hool, G. A., 286, 387, 688.  
 Hooley, W., 576.  
 Hooper, C. H., 442, 561.  
 Hooper, J. J., 873.  
 Hootman, H. D., 442.  
 Hoover, L. G., 139.  
 Hope, G. D., 718.  
 Hopkins, A. W., 896.  
 Hopkins, B. E., 783.  
 Hopkins, E. F., 44, 740.  
 Hopkins, E. S., 432.  
 Hopkins, F. G., 461, 782, 856.  
 Hopkins, J. G., 478.  
 Hopkins, J. V., 700.  
 Hopkins, M., 96, 395.  
 Hoppert, C. A., 678.  
 Horlacher, L. J., 369.  
 Horn, D. W., 278.  
 Horne, W. D., 413.  
 Horne, W. T., 752, 838, 845.  
 Hornibrook, M., 242.  
 Horning, H. L., 188.  
 Horning, J. G., 253, 884.  
 Horsfall, J. L., 557.  
 Horsfall, R. B., 844.  
 Horton, E., 346.  
 Horton, R. E., 114, 115, 415, 416, 808.  
 Hottes, A. C., 39.  
 Howard, J. T., 774.  
 Howard, L. O., 53, 845, 897.  
 Howard, N. O., 753.  
 Howard, R. F., 335.  
 Howe, H. E., 196.  
 Howe, P. E., 762, 883.  
 Howitt, J. E., 648, 655.  
 Howlett, F. S., 299, 699, 835.  
 Hubbard, C. M., 171.  
 Hubbard, W. F., 744.  
 Hubert, E. E., 843.  
 Hudson, R. J. H., 485.  
 Hudson, R. M., 96.  
 Hudspeth, C. B., 84.  
 Huestis, R. R., 731.

Hughes, A. C., 286.  
 Hull, D. C., 398, 399.  
 Hulme, W., 205.  
 Hultz, F. S., 371.  
 Hume, A. N., 638.  
 Hume, E. M., 265, 567, 568.  
 Humphrey, G. C., 678.  
 Humphreys, W. J., 415, 808.  
 Hungerford, C. W., 244, 745.  
 Hunnius, T., 625.  
 Hunt, C. H., 277.  
 Hunt, H. A., 616.  
 Hunt, N. R., 745, 753.  
 Hunter, M. M., 597.  
 Hunter, W. D., 356, 357.  
 Hunwicke, R. F., 378.  
 Hurd, A. M., 328.  
 Husein, M. H., 795.  
 Hussey, H. D., 186.  
 Huston, G., 593.  
 Hutchins, L. M., 22.  
 Hutchins, W. A., 186.  
 Hutson, J. C., 455, 556.  
 Hutton, M. K., 263.  
 Huxley, V. S., 500.  
 Hypes, J. L., 297.

Ibuki, T., 63.  
 Ihne, H., 616.  
 Ilsaas, T., 193.  
 Ingham, G., 412.  
 Ingram, J. W., 525.  
 Irvine, J. C., 505.  
 Isaac, P. V., 57.  
 Isely, D., 558, 663, 850.  
 Ishido, 564.  
 Ishiware, F., 204.  
 Isikawa, Z., 330.  
 Israelsen, O. W., 384.  
 Itano, A., 498.  
 Ives, F. W., 100.  
 Iveson, W. L., 717.  
 Ivey, J. E., 274.  
 Ivory, E. P., 187.  
 Iyengar, K. R. K., 282, 680, 681.

Jack, H. W., 536.  
 Jack, R. W., 153.  
 Jackson, A. B., 344.  
 Jackson, C. M., 566.  
 Jackson, F. W., 172.  
 Jackson, H. C., 76.  
 Jackson, W., 774.  
 Jacob, W. R. LeG., 345.  
 Jacobs, S. M., 480.  
 Jacques, A. G., 686.  
 Jaffa, M. E., 342, 497.  
 Jager, F., 157, 458.  
 James, L., 152.  
 Jamieson, G. S., 408.  
 Janiszowski, M. B., 439.  
 Januschke, E., 881.  
 Jardine, J. T., 867.  
 Jardine, N. K., 57.  
 Järvinen, K. K., 613, 763.  
 Jarvis, E., 457, 848.

Jefferson, L. P., 690.  
 Jefferson, M., 13, 415.  
 Jehle, R. A., 842.  
 Jendrassik, A., 506.  
 Jenkins, E. H., 696.  
 Jenkins, E. W., 342.  
 Jenkins, F. W., 298.  
 Jenkins, M. T., 333.  
 Jenks, F. B., 496.  
 Jennings, H. S., 129, 730.  
 Jensen, A., 792.  
 Jensen, H. I., 315, 415.  
 Jephcott, H., 664.  
 Jepson, C., 124.  
 Jepson, W. L., 744.  
 Jerrom, J. H. G., 479.  
 Jersey, V., 161.  
 Jesness, O. B., 192.  
 Jett, C. U., 96.  
 Job, H. K., 355.  
 Jochems, S. C. J., 236.  
 Jodidi, S. L., 712.  
 Joest, E., 379.  
 Joffe, J. S., 20, 726.  
 Johannsen, W., 729.  
 John, A. O., 375.  
 John, W. C., 194.  
 Johnson, A. A., 187.  
 Johnson, A. G., 145.  
 Johnson, C. N., 98.  
 Johnson, D. P., 88.  
 Johnson, E. (Norway), 521.  
 Johnson, E. (U.S.D.A.), 658.  
 Johnson, H. W., 612, 809.  
 Johnson, J., 41, 746, 749.  
 Johnson, O. R., 591.  
 Johnson, R. P. A., 187.  
 Johnson, S. C., 257.  
 Johnson, T. C., 550.  
 Johnson, W. T., 185, 576.  
 Johnstin, R., 508.  
 Johnston, E. A., 98, 485.  
 Johnston, E. C., 709.  
 Johnston, E. S., 126.  
 Johnston, I. H., 754.  
 Johnston, R. N., 39.  
 Johnston, T. H., 358, 359, 455.  
 Jollos, V., 252.  
 Jolly, J., 680.  
 Jolly, N. W., 545.  
 Jones, C. H., 324, 367.  
 Jones, C. P., 107, 621.  
 Jones, D. B., 64, 360, 711, 775.  
 Jones, E. H., 796.  
 Jones, E. R., 100, 792.  
 Jones, F. R., 146, 652, 839.  
 Jones, F. S., 184.  
 Jones, G. W., 387.  
 Jones, H. A., 741.  
 Jones, I. R., 73.  
 Jones, J. H., 362, 364, 775.  
 Jones, J. M., 66, 775.  
 Jones, J. P., 498.  
 Jones, J. S., 7.

Jones, L. K., 751.  
 Jones, L. R., 45, 348.  
 Jones, S. C., 322.  
 Jones, S. G., 352.  
 Jones, T. H., 847.  
 Jones, W. H., 123.  
 Jonesco, St., 22, 224, 326.  
 Jong, A. W. K. de, 140.  
 Jordan, H. V., 617.  
 Jorgenson, G. E., 884.  
 Joseph, A. F., 316, 421.  
 Joseph, W. E., 574, 776.  
 Joshi, B. M., 147.  
 Joshi, K. V., 32.  
 Joslin, E. P., 766.  
 Joy, G. C., 808.  
 Judd, C. S., 844.  
 Jull, M. A., 274, 473.  
 Junius, E. W., 685.  
 Jurney, R. C., 419.

Kabeshima, H., 63.  
 Kadramer, R. D., 316.  
 Kahlenberg, L., 610.  
 Kajanus, B., 27, 237, 633.  
 Kalkus, J. W., 184, 584.  
 Kammerer, P., 130.  
 Kammlade, W. G., 271.  
 Kappen, H., 514.  
 Karper, R. E., 431.  
 Karraker, P. E., 618.  
 Kasai, M., 248.  
 Katjkov, C. B., 255.  
 Katō, S., 330.  
 Kauffman, T. E., 695.  
 Kaupp, B. F., 82, 274, 872.  
 Kawakami, K., 801.  
 Kaye, W. J., 455.  
 Kearney, T. H., 24.  
 Keefer, C. S., 684.  
 Keen, B. A., 809, 812.  
 Kegerreis, C. S., 188.  
 Kellholz, F. J., 96.  
 Keister, J. T., 112.  
 Keith, M. H., 464.  
 Keitt, G. W., 656, 750.  
 Keller, H., jr., 492.  
 Kelley, A. P., 513, 619.  
 Kelley, J. B., 97.  
 Kelley, M. A. R., 97, 190, 388, 689.  
 Kellogg, J. W., 821.  
 Kellogg, R. S., 545, 838.  
 Kellogg, V., 897.  
 Kelly, C. D., 781.  
 Kelly, E., 875.  
 Kelly, J. P., 430, 445.  
 Kelsall, A., 453, 844.  
 Kelser, R. A., 64.  
 Kelsey, G. E., 533.  
 Kemmerer, T. W., 151.  
 Kempster, H. L., 467, 577.  
 Kempton, F. E., 649.  
 Kempton, J. H., 129, 528, 529.  
 Kendrick, J. B., 650, 655.  
 Kenety, W. H., 49.



- Kennedy, C., 160, 163, 175.  
 Kent, H. L., 298.  
 Kent, S. S. S., 786.  
 Kephart, L. W., 740.  
 Ker, D. R. E.—, 574.  
 Kern, F. D., 446.  
 Kernkamp, H. C. H., 182.  
 Kerr, R. H., 196, 804.  
 Kessler, D. W., 887.  
 Kessler, N. A., 599.  
 Kettering, C. F., 96.  
 Keuchenius, A. A. M. N., 645.  
 Keuchenius, P. E., 49.  
 Khazanoff, A., 450.  
 Khouvine, Y., 763.  
 Kidd, F., 449.  
 Kidder, A. F., 697.  
 Kieferle, F., 600.  
 Kiesel, 600.  
 Kiesselbach, T. A., 233.  
 Killough, D. T., 45.  
 Kilpatrick, W. H., 597.  
 Kimball, D. S., 895.  
 Kimball, H. H., 115, 116.  
 Kincer, J. B., 14, 207.  
 King, B. M., 799.  
 King, C. J., 132, 137, 146, 747.  
 King, F. G., 369.  
 King, G. F., 93.  
 King, H. D., 822.  
 Kinne, W. S., 286, 387, 688.  
 Kinney, E. J., 830.  
 Kirby, A. H., 256, 433.  
 Kirby, R. S., 549, 599, 699, 746.  
 Kircher, J. C., 40.  
 Kirkpatrick, E. L., 294, 595, 892.  
 Kirkpatrick, R. Z., 808.  
 Kirkpatrick, T. W., 52.  
 Kirkwood, G. B., 253, 884.  
 Kirkwood, J. E., 240.  
 Kitchen, H. D., 766.  
 Kitt, T., 380.  
 Kittredge, J., jr., 646.  
 Kleiber, M., 866.  
 Klein, C. A., 205.  
 Kleine, R., 255.  
 Kleinmann, H., 312, 713.  
 Klika, J., 143.  
 Klimmer, M., 180.  
 Kandel, H. C., 473, 576.  
 Knapp, B., 594.  
 Knight, H., 151.  
 Knight, H. G., 195.  
 Knight, H. H., 755.  
 Knight, H. L., 5.  
 Knight, L. I., 125.  
 Knoch, K., 13.  
 Knorr, M., 478.  
 Knott, C. G., 414.  
 Knott, J. C., 276.  
 Knowlton, F. L., 486, 888.  
 Knox, R. G., 575, 777.  
 Koch, A., 720.  
 Koch, F. C., 612.  
 Kocher, A. M., 519.  
 Koeber, J., 190.  
 Koenig, M., 336.  
 Koestler, G., 378.  
 Kokoski, F. J., 774.  
 Kolb, J. H., 691.  
 Kollsted, E., 600.  
 Kolmer, J. A., 584.  
 Kolthoff, J. M., 613.  
 Komers, K., 238.  
 Komp, W. H. W., 758.  
 Kondyreff, B. E., 372.  
 König, 393.  
 König, J., 17, 18, 311.  
 Konopacka, W., 353.  
 Koon, R. M., 498.  
 Kopeć, S., 452, 631, 732.  
 Köppen, W., 807.  
 Korenchevsky, V., 63, 165, 261, 265, 361, 667, 856.  
 Korstian, C. F., 150.  
 Kotowski, F., 429.  
 Kottur, G. L., 531.  
 Koudela, S., 677.  
 Kozlowski, A., 224.  
 Kramer, B., 63, 166.  
 Kramer, M. M., 60.  
 Kranich, F. N. G., 588.  
 Krasnow, F., 769.  
 Krassowska, W., 348, 349.  
 Kratz, A. P., 589.  
 Krausse, A., 555.  
 Kreitmann, L., 343.  
 Kremer, T., 639.  
 Krichewsky, S., 616.  
 Krische, P., 724.  
 Kristensen, M., 478.  
 Kroger, E., 18.  
 Krogh, A., 379.  
 Kron, O., 421.  
 Krout, W. S., 650, 651, 655.  
 Krueger, W. W., 496.  
 Kruhm, A., 139.  
 Krusekopf, H. H., 419.  
 Kufferath, H., 875.  
 Kuhlmann, E., 238.  
 Kükenthal, I. W., 252.  
 Kularni, G. S., 147.  
 Kunst, F. B., 169.  
 Kuntz, P. R., 738.  
 Kunz, G. F., 709.  
 Küpfer, M., 825.  
 Kurupad, G. S., 33.  
 Kuttner, A., 478, 562.  
 Kuzmin, M. S., 211.  
 Kwisda, A., 322.  
 Lachmund, H. G., 544.  
 Lacroix, D. S., 498.  
 La Croix, M. M., 174.  
 Ladd, C. E., 94.  
 LaForge, F. B., 505, 806.  
 Lagatu, H., 214, 644, 742.  
 Lago, F. P., 672.  
 Laidlaw, W., 552.  
 Laist, T. F., 97.  
 Lakon, G., 444.  
 Lamaster, J. P., 73.  
 Lamb, A. R., 64, 113.  
 Lambert, E. B., 649.  
 Lambert, R. A., 463, 464.  
 Lambourne, L., 250.  
 La Mer, V. K., 507.  
 Lamkey, E. M. R., 697.  
 Lamson, P. D., 262.  
 Landis, J., 870.  
 Landon, I. K., 697.  
 Lane, C. H., 94, 895.  
 Lane-Poole, C. E., 743.  
 Langmack, P. V. F. P., 781.  
 Langworthy, A. E., 65, 77.  
 Lansden, H. B., 96.  
 Lantow, J. L., 65.  
 Lantz, H. L., 37.  
 Laplaud, M., 869.  
 Larbaud, M., 324.  
 Larison, E. L., 196.  
 Larson, A. H., 137.  
 Larson, A. O., 850.  
 Larson, J. L., 388.  
 Larsson, E. L., 615.  
 LaRue, C. D., 754.  
 Latimer, H. B., 872.  
 Latshaw, W. L., 20.  
 Laughlin, G. F., 820.  
 Lavialle, P., 857.  
 Lavier, G., 81, 184.  
 La Wall, C. H., 804.  
 Lawyer, G. A., 150, 252, 355.  
 Leach, J. G., 42, 143, 653.  
 Leake, H. M., 704.  
 Learmonth, J. R., 783.  
 Leavenworth, C. S., 710.  
 Leavitt, C., 443.  
 Lebour, M. V., 252.  
 Lecomte, H., 647.  
 Lee, A. M., 381.  
 Lee, A. R., 72, 174, 780.  
 Lee, H. A., 322, 549, 752, 795.  
 Lee, L., 789.  
 Lee, L. L., 319.  
 Lee, W. W., 474.  
 Leer, W. E., 697.  
 Lees, A. H., 557.  
 Lefevre, G., 528.  
 Lefferty, H. A., 200.  
 Lefroy, H. M., 151.  
 Le Gavrian, P., 286.  
 Leggatt, C. W., 338.  
 Lehman, S. G., 840.  
 Lehmann, E., 527.  
 Lehmann, E. W., 96.  
 Leib, R. W., 158.  
 Leighton, G. R., 167.  
 Leighty, C. E., 129, 648, 650, 738.  
 Leitch, A., 199.  
 Leitch, R. H., 676.  
 Le Louet, G., 481.  
 Lemmermann, O., 232, 233, 235, 425, 623, 818.  
 Lennes, N. J., 898.  
 Leonard, F. B., jr., 885.

- Leonard, J. B., 484.  
 Leonhards, R., 220.  
 Lepkovsky, S., 780.  
 Leppan, H. D., 333.  
 Leroy, A.-M., 471.  
 Lesage, P., 325, 428.  
 Leslie, W. R., 36, 269, 273, 591.  
 Lesné, E., 466, 670, 858.  
 Lesne, P., 850.  
 Letard, E., 267.  
 Leval't-Ezerskii, M. K., 317.  
 Levene, P. A., 770.  
 Le Vesconte, A. M., 500.  
 Levett-Yeats, G. A., 252.  
 Levine, M., 526, 745.  
 Lewis, C. I., 397.  
 Lewis, F. J., 242.  
 Lewis, H. R., 275.  
 Lewis, M. R., 100.  
 Lewis, P. A., 80.  
 Lichtenberg, F. von S., 255.  
 Lichtenwalner, D. C., 16.  
 Liese, J., 150.  
 Liesegang, H., 514.  
 Lillie, F., 825.  
 Lima, A. da C., 51.  
 Lind, G., 238.  
 Lindemuth, 439.  
 Lindfors, K. R., 715.  
 Lindgren, H. A., 867.  
 Lindsey, J. B., 168.  
 Lindstrom, E. W., 430, 435.  
 Linfield, F. B., 195, 896.  
 Ling, A. R., 312, 313.  
 Link, G. K. K., 46, 652, 748, 840.  
 Linke, J. A., 495.  
 Linlithgow, 292, 690.  
 Lipman, C. B., 516.  
 Lipman, J. G., 219, 896.  
 Lippincott, W. A., 174, 330, 873.  
 Lipscomb, G. F., 349.  
 Liskier, D., 169, 600.  
 List, G. M., 151.  
 Little, R. B., 184, 479, 883.  
 Lively, C. E., 896.  
 Livesay, E. A., 900.  
 Livingston, B. E., 22, 328.  
 Livingston, L. F., 99.  
 Livshis, L., 767, 802.  
 Lloyd, A. M., 58.  
 Lloyd, J. W., 395.  
 Lloyd, W. A., 695.  
 Locklin, H. D., 113, 195, 598.  
 Loeb, J., 599.  
 Loeb, L., 635, 826.  
 Löhnis, F., 17, 526, 728.  
 Lomanitz, S., 625.  
 Lomba, J. L., 62, 166, 465, 772.  
 Long, D. D., 137.  
 Loomis, H. M., 709.  
 Loomis, W. E., 300.  
 Lopez-Lomba, J., 62, 166, 465, 772.  
 Lord, L., 832.  
 Louet, G. Le, 481.  
 Loughlin, G. F., 724.  
 Lounsbury, C. P., 155, 259, 359, 555.  
 Love, H. H., 229, 827.  
 Loveland, G. A., 715.  
 Lovett, A. L., 153, 844.  
 Lowry, E. M., 645.  
 Lowry, G. A., 829.  
 Lowry, M. W., 814.  
 Lubimenko, V., 126.  
 Luce, E. M., 162.  
 Luce, W. A., 441.  
 Ludwig, C. A., 536, 549, 638.  
 Luithly, J. A., 580.  
 Lund, R. F., 496.  
 Lundquist, G. A., 393.  
 Lunn, A. G., 590.  
 Lush, J. L., 177, 775.  
 Lute, A. M., 740.  
 Lutman, A. S., 338.  
 Lutman, B. F., 628.  
 Lützelburg, 735.  
 Lyford, C. A., 495, 597.  
 Lytle, W. H., 879.  
 Mabee, W. B., 57.  
 MacAndrews, A. H., 844.  
 MacArthur, D. N., 323.  
 MacArthur, W. P., 762.  
 McAtee, W. L., 150.  
 McAuliffe, J. P., 116.  
 Macbride, 735.  
 McBride, O. C., 899.  
 Macbride, T. H., 727.  
 McCampbell, C. W., 65.  
 McCandlish, A. C., 275, 579.  
 McCarrison, R., 668, 865.  
 McCarty, G., 647.  
 McCarty, M. A., 169.  
 McClary, J. A., 269, 271, 272, 275, 592.  
 McClellan, M. P., 79.  
 McClelland, T. B., 533, 539.  
 McClendon, J. F., 263.  
 McClintok, J. A., 140, 553, 751.  
 McCollam, M. E., 134, 195, 520.  
 McColloch, J. W., 53, 54.  
 McCollum, E. D., 722.  
 McCollum, E. V., 162, 263.  
 McCool, M. M., 419, 617.  
 McCormick, M. G., 597.  
 McCrea, A., 630.  
 McCrory, S. H., 100.  
 McCue, C. A., 18.  
 McCuen, G. W., 98, 588.  
 McCulloch, L., 348.  
 McCunn, J., 482.  
 McCurry, J. B., 751.  
 MacDaniels, L. H., 37.  
 McDaniel, E. I., 454.  
 McDole, G. R., 726.  
 MacDonald, M. B., 363.  
 McDonald, A. H. E., 774.  
 McDonald, R. E., 53, 740.  
 McDonnell, C. C., 196.  
 MacDougal, A. F., 899.  
 McDougall, J. C., 433.  
 MacDougall, R. S., 153.  
 McGeorge, W. T., 216, 619.  
 MacGillivray, A. D., 253, 899.  
 McGowan, J. P., 172, 683.  
 McHargue, J. S., 463, 617.  
 Macht, D. I., 684.  
 McIlwaine, R., 837.  
 MacIntire, B. G., 115.  
 MacIntire, W. H., 522, 523, 625, 819.  
 MacIntosh, J., 676.  
 McIntyre, H. L., 257.  
 Mack, W. B., 340.  
 Mackay, H. M. M., 567.  
 McKay, M. B., 747.  
 McKee, C., 133.  
 Mackenzie, W. A., 234.  
 McKerral, A., 231.  
 Mackie, J. R., 828.  
 Mackie, W. W., 43.  
 McKimmon, J. S., 896.  
 McKinney, H. H., 145, 649, 839.  
 Mackintosh, J., 278.  
 Macklin, T., 594.  
 McLean, A. J., 282.  
 McLean, G. E., 895.  
 McLean, H. C., 219, 726.  
 MacLeod, G., 764.  
 MacLeod, G. F., 557, 698.  
 MacLeod, J. J. R., 461.  
 MacMillan, H. G., 654.  
 McMurry, F. M., 404, 895.  
 McMurtrey, J. E., jr., 621.  
 McNair, J. B., 181.  
 McNally, W. D., 77.  
 McNary, C. L., 743.  
 McNeil, G. L., 658.  
 McNicholas, H. J., 714.  
 Macoun, W. T., 339.  
 McRae, W., 42, 552.  
 McRostie, G. P., 432, 651.  
 Macself, A. J., 141.  
 McWhorter, F. P., 248.  
 Macy, H., 179.  
 Madison, L. C., 699.  
 Magasanik, J., 865.  
 Maggs, J. H., 782.  
 Magness, J. R., 541.  
 Magnusson, H. P., 727, 813.  
 Magnusson, H., 685.  
 Magoon, C. A., 741.  
 Magruder, R., 300.  
 Mahin, E. G., 714.  
 Mains, E. B., 129, 648.  
 Mains, G. H., 505, 806.  
 Maire, E. D., 282.



- Mairs, T. I., 95.  
 Maisonneuve, A. P., 158.  
 Major, T. G., 347.  
 Malin, D. F., 573.  
 Malinowski, E., 633.  
 Malloch, W. S., 36.  
 Mangain, D., 40.  
 Mancini, E., 728.  
 Mangels, C. E., 500.  
 Mangenot, G., 222, 325.  
 Mangin, L., 244.  
 Manhart, V. C., 179.  
 Mann, A. R., 896, 898.  
 Mann, C. R., 895.  
 Mann, H. H., 147, 247.  
 Mann, W. M., 155.  
 Manns, T. F., 546, 551.  
 Manson, J. L., 88.  
 Maquenne, L., 126, 128, 325, 327.  
 Marais, A., 412.  
 Marange, 805.  
 Marble, L. M., 542.  
 Marchal, P., 345, 661.  
 Marchand, B. de C., 412, 418, 420, 815.  
 Marchand, H., 168.  
 Marcovitch, S., 259, 760, 845.  
 Marcq, J., 868.  
 Marek, J., 379.  
 Marholdt, O., 235.  
 Markley, K. S., 712.  
 Marlatt, A. L., 896.  
 Marr, J. C., 84.  
 Marrian, G. F., 260.  
 Marriott, W. M., 856.  
 Marsh, C. D., 77.  
 Marsh, H., 481.  
 Marshall, F. H. A., 366.  
 Marston, A., 896.  
 Marston, H. W., 65, 67.  
 Martin, F. J., 421, 816.  
 Martin, G. R., 781.  
 Martin, H. M., 185.  
 Martin, J. C., 221, 723, 813.  
 Martin, J. H., 33, 639.  
 Martin, R. D., 30.  
 Martin, W. H., (N. J.), 47, 653.  
 Martin, W. H. (Pa.), 580.  
 Martini, E., 255, 453.  
 Martin-Zédé, 225.  
 Marvin, C. F., 114.  
 Marzell, H., 140.  
 Mason, E. D., 823.  
 Mason, E. H., 766.  
 Mason, H. H., 762.  
 Mason, P. W., 454.  
 Massee, A. M., 845.  
 Massey, G. B., 286.  
 Massey, L. M., 753.  
 Massey, R. E., 816.  
 Masurovsky, B. I., 281, 580, 679.  
 Mathews, S. J., 298.  
 Mathewson, W. E., 714.  
 Matsumoto, T., 43.  
 Matthews, E. N., 493.  
 Matthews, G. C., 157.  
 Matthews, M. L., 896.  
 Mattick, A. T. R., 782.  
 Mattill, H. A., 867.  
 Mattoon, W. R., 40, 241, 543.  
 Mattos, A. T. de, 359.  
 Matz, J., 351.  
 Maume, L., 644.  
 Maumené, A., 275.  
 Maupas, A., 621.  
 Mavor, J. W., 226, 529.  
 Maw, W. A., 161, 274, 473.  
 Maxson, A. C., 755.  
 May, D. W., 597, 676.  
 May, E., jr., 743.  
 Maynard, E. J., 64.  
 Maynard, H. H., 393.  
 Maynard, L. A., 479, 578, 869.  
 Mayr, K., 881.  
 Mead, E., 899.  
 Medina, M., 236.  
 Meek, C. S., 516.  
 Megee, C. R., 496.  
 Meggitt, A. A., 717.  
 Mehl, P., 91.  
 Mehurin, R. M., 712.  
 Meier, F., 651.  
 Meier, F. C., 46.  
 Meigs, C. C., 724.  
 Meinsinger, C. L., 415.  
 Meinzer, O. E., 83, 685.  
 Meister, G. K., 600.  
 Melander, A. L., 844.  
 Melchers, L. E., 550, 634, 649.  
 Melhus, I. E., 648, 680.  
 Melvin, B. L., 893.  
 Menaul, P., 468, 610, 614.  
 Mendel, L. B., 852.  
 Mendiola, N. B., 537.  
 Mendiivil y Valesco, J. M. D. de., 832.  
 Mennecke, M., 324.  
 Mercier, L., 850.  
 Merckenschlager, F., 426.  
 Merrill, A. S., 898.  
 Merrill, E. D., 96.  
 Merrill, F. A., 898.  
 Merrill, G. B., 155.  
 Merritt, R. P., 793.  
 Merwe, A. R. van der, 369.  
 Merwe, C. P. van der, 257.  
 Merz, A. R., 322.  
 Metcalf, W., 240.  
 Metz, C. W., 528, 823.  
 Meyer, A. H., 117, 617.  
 Meyer, E., 593.  
 Meyer, K. F., 785.  
 Meyer, R., 255.  
 Meyer, W. I., 200.  
 Mhaskar, K. S., 380.  
 Miall, B., 253, 359.  
 Michael, L. G., 296.  
 Michaels, R., 395.  
 Michels, N. A., 783.  
 Michener, C. K., 538, 794.  
 Mickel, C. E., 336, 755.  
 Middleton, H. E., 811.  
 Middleton, W., 458, 557.  
 Midgley, E., 234, 695.  
 Miège, E., 438.  
 Mignon, H. L., 462.  
 Milbrath, D. G., 451.  
 Miles, G. F., 599.  
 Miles, H. W., 458, 560.  
 Miller, A. E., 156.  
 Miller, E. C., 28, 425.  
 Miller, E. R., 115.  
 Miller, E. S., 806.  
 Miller, G. S., 676.  
 Miller, M. F., 15.  
 Miller, P. E., 120.  
 Miller, R. C., 277.  
 Miller, W. P., 99, 385.  
 Milligan, S., 600.  
 Mills, J., 897.  
 Mills, O. L., 490.  
 Milne, D., 480.  
 Milner (Viscount), 701.  
 Milward, R. C., 838.  
 Minchin, A. F., 141.  
 Minett, F. C., 480.  
 Minoura, T., 826.  
 Mischall, J., 178.  
 Misner, E. G., 89.  
 Mitchell, E. L., 890.  
 Mitchell, H. H., 267, 464.  
 Mitchell, H. S., 764.  
 Mitchell, W. F., 690.  
 Mitscherlich, E. A., 118, 532, 724.  
 Mitscherling, W. O., 206.  
 Miyake, C., 246.  
 Miyazawa, B., 330.  
 Mohler, J. R., 79, 608.  
 Mohr, O. L., 729.  
 Moir, W. S., 843.  
 Molinari, E., 801.  
 Møllgaard, H., 572, 676.  
 Molliard, M., 22, 328.  
 Moloney, P. J., 611.  
 Monahan, A. C., 893.  
 Monier-Williams, G. W., 805.  
 Monroe, C. G., 88.  
 Montessus de Ballore, De, 12.  
 Montreuil, J. E., 537.  
 Mooers, C. A., 31.  
 Moore, G. T., 897.  
 Moore, H. C., 436.  
 Moore, H. F., 709.  
 Moore, M., 676.  
 Moore, M. G., 408.  
 Moore, R. A., 398.  
 Moore, W. L., 314.  
 Moreau, E., 91.  
 Morgan, A. C., 53.  
 Morgan, A. F., 59, 462, 857.  
 Morgan E. L., 394, 893.  
 Morgan, G., 133.

- Morgan, H. A., 399.  
 Morgan, H. J., 184, 787, 879.  
 Morgan, M. F., 218, 512.  
 Morgan, T. H., 328, 331, 527.  
 Morgenthaler, O., 762.  
 Morinaka, K., 862.  
 Morize, H., 415, 511.  
 Morrill, J. S., 3, 603.  
 Morris, E. A. M., 793.  
 Morris, J. L., 161.  
 Morris, O. M., 440.  
 Morris, R. L., 507.  
 Morrison, B. Y., 140, 239.  
 Morrow, C. A., 146.  
 Morse, F. W., 621, 624, 631.  
 Morse, H. N., 794.  
 Morse, S. F., 13.  
 Morstatt, H., 142.  
 Morton, J. N., 242.  
 Moses, M. S., 528, 823.  
 Mosier, J. G., 418.  
 Mosséri, V. M., 512, 721, 722.  
 Mote, D. C., 53.  
 Mottram, E. C., 169.  
 Mottram, J. C., 565.  
 Mottram, V. H., 169.  
 Moulton, C. R., 196, 466, 569, 868.  
 Mountford, L. J., 479.  
 Mow, A. J. G., 400.  
 Mozzette, G. F., 453.  
 Mudge, C. S., 279, 377.  
 Mudge, J. B., 196.  
 Muhlfeld, M., 770.  
 Muir, F., 756.  
 Mukherji, P., 894.  
 Müller, E., 677.  
 Muller, H. J., 823.  
 Muller, J. H., 478.  
 Müller, U., 647.  
 Müller, W., 234.  
 Mumford, F. B., 466, 467, 626, 895.  
 Mumford, H. W., 396.  
 Mundinger, F. G., 453, 900.  
 Munn, M. T., 740.  
 Munns, E. N., 240, 646, 837.  
 Munro, W. A., 377, 468, 472.  
 Münter, F., 423, 814.  
 Murdock, H. E., 133, 385, 590.  
 Murphey, F. T., 699.  
 Murphy P. A., 448.  
 Murphy, W. P., 766.  
 Murray, J. K., 679.  
 Murray, M. F., 766.  
 Mussehl, F. E., 576.  
 Musselman, H. H., 289, 496.  
 Musser, A. M., 536.  
 Mutkekar, S. G., 433.  
 Myer D. S., 896.  
 Myers, C. E., 439, 896.  
 Myers, C. H., 234.  
 Myers, H. W., 754.  
 Nachtsheim, H., 128.  
 Nagayo, M., 668.  
 Nagler, F. A., 587.  
 Nagpurkar, S. D., 147, 247.  
 Naito, H., 862.  
 Nasir, S. M., 420.  
 Naudain, G. G., 712.  
 Nechleba, 255.  
 Neethling, E. J., 443.  
 Neff, G. C., 98.  
 Nègre, L. 284, 584.  
 Neidig, R. E., 203, 726, 813.  
 Nelson, D. H., 119.  
 Nelson, E. M., 363, 364.  
 Nelson, J. W., 497.  
 Nelson, R., 651.  
 Nelson, V. E. 362, 768, 769.  
 Némec, A., 222, 507.  
 Neubauer, H., 118.  
 Neumann, K., 76.  
 Nevens, W. B., 73.  
 Newbecker, B. M., 857.  
 Newbury, M. C., 95.  
 Newcomer, E. J. 844.  
 Newell, F. H., 385, 482.  
 Newell, W., 399.  
 Newhall, A. G., 651.  
 Newham, H. B., 783.  
 Newlands, G., 418.  
 Newlin, J. A., 187.  
 Newman, H. E. 844.  
 Newman, L. H., 447, 231.  
 Newton, J. D., 524.  
 Newton, J. H., 151.  
 Newton, R., 125, 137.  
 Newton, R. G., 273.  
 Newton, W., 326.  
 Nicholls P., 589.  
 Nicholls, W. D., 199.  
 Nichols, E. S., 416.  
 Nichols, M. L., 98.  
 Nielsen, F. C., 844.  
 Niesley, H. G., 699.  
 Nilssen, M. F., 94.  
 Nilsson, G., 736.  
 Nisikado, Y. 246.  
 Nitzescu, I.-I., 858, 860.  
 Nixon, L. M., 169.  
 Nobbs, E. A., 270, 469.  
 Nobécourt, P., 244.  
 Noble, B. E., 864.  
 Noble, E. C., 461.  
 Nodder, C. R., 134.  
 Noland, T. W., 873, 890.  
 Noll, C. F., 432.  
 Nolte, O., 218, 220, 338, 421, 423, 424, 521, 624, 818.  
 Norris, L. C., 578.  
 Norris, R. V., 214, 722.  
 Norton, B. S., 842.  
 Nougaret, R. L., 451.  
 Nourse, E. G., 200.  
 Nourse, M. R., 820.  
 Novaes, J. de Campos, 459.  
 Novero, T., 436, 638.  
 Nowell, W., 354.  
 Nussbaum, S., 388.  
 Obaton, F., 222.  
 Oberly, E. R., 900.  
 Ocfemia, G. O., 654.  
 O'Donnell, F. G., 745.  
 O'Dwyer, M. H. 168, 311.  
 Oelsner, A., 720.  
 Oestlund, O. W., 755.  
 Oglivie, L., 200.  
 Ohomori, K., 865.  
 Okada, S., 63.  
 O'Kane, W. C., 710.  
 O'Kelly, J. F., 735.  
 O'Kelly R. E., 710.  
 Older, C., 790.  
 Oldershaw, A. W., 29.  
 Oldis, G. J., 698.  
 O'Leary, I. P., 395.  
 Olitsky, P. K., 897.  
 Olney, R., 100.  
 Olson, N. E., 783.  
 Olson, O., 237, 437.  
 Ong, E. R. de, 658, 663.  
 Onslow, M. W., 626.  
 Oosthuizen, J. du P., 236.  
 Opitz, K., 436.  
 Orcutt, M. L., 788.  
 Orr, A., 709.  
 Orr, W. J., 669.  
 Orrben, C. L., 520.  
 Ort, E. D. van, 355.  
 Orton, C. R., 445, 653, 745.  
 Orton, W. A., 32.  
 Orwin, C. S., 290.  
 Osborn, H., 453, 755.  
 Osborn, H. T., 356.  
 Osborne, T. B., 710.  
 Osborne, W. B., jr., 743.  
 Osenbrug, A., 133.  
 Oskamp, J., 541, 543.  
 Osmun, A. V., 651, 654.  
 Ostrander, J. E., 116, 510, 809.  
 Oswald, W. L., 740.  
 Otis, F. A., 797.  
 Outhouse, J., 463.  
 Overholser, E. L., 409.  
 Overholt, V., 486.  
 Overman, O. R., 10.  
 Overton, M. H., 389.  
 Owen, W. L., 410, 728.  
 Owen-John, A., 375.  
 Owens, C. E., 148, 244, 750.  
 Pack, D. A., 536.  
 Packer, B. G., 792.  
 Paguirigan, D. B., 833.  
 Painter, T. S., 825.  
 Palladin, A., 160, 163.  
 Palmer, A. W., 639.  
 Palmer, G. W., 589.  
 Palmer, L. S., 108, 163, 164, 175, 179.  
 Pander, A. von, 436.  
 Pandit, G. B., 28.  
 Panfiloff, E. I., 600.  
 Panganiban, E. H., 815.  
 Papanicolaou, G. N., 635.



- Parfitt, E. H., 180.  
 Park, E. A., 61, 262.  
 Park, E. W., 855.  
 Parker, C. S., 146.  
 Parker, F. W., 203, 524.  
 Parker, G. L., 789.  
 Parker, J. H., 538, 634, 828.  
 Parker, J. R., 798.  
 Parker, S. L., 497.  
 Parker, W. B., 693.  
 Parker, W. H., 336.  
 Parkes, A. S., 730.  
 Parks, K. E., 190.  
 Parks, T. H., 448.  
 Parnell, F. R., 600.  
 Parr, A. E., 28.  
 Parr, V. V., 368.  
 Parrott, P. J., 557.  
 Parshley, H. M., 755, 844.  
 Parsons, J. L., 586.  
 Parsons, T. R., 507.  
 Pasquier, R. Du., 836.  
 Patch, E. M., 755.  
 Paterson, J. W., 94.  
 Paterson, W. G. R., 371.  
 Paton, J. B., 506, 763.  
 Patouillard, N., 42.  
 Patten, A. J., 196.  
 Patten, G. R., 738.  
 Patterson, H. J., 898.  
 Patton, R. T., 485.  
 Pavel, A., 594.  
 Payne, L. F., 685.  
 Peabody, G., 95.  
 Peacock, G., 373.  
 Pearl, R., 729, 872.  
 Pearse, A. S., 830.  
 Pearson, R. A., 896.  
 Pearson, R. S., 40.  
 Pease, V. A., 196.  
 Peavy, L., 198.  
 Peck, C. L., 323.  
 Peck, F. W., 896.  
 Pedersen, L. T., 872.  
 Pegler, H. S. H., 670.  
 Peglion, V., 46.  
 Peirce, F. T., 234, 830.  
 Peirson, H. B., 153.  
 Peitersen, A. K., 739.  
 Peltier, G. L., 446, 752.  
 Pelton, W. C., 439.  
 Pember, F. R., 16.  
 Pemberton, J. E., jr., 744.  
 Pendleton, R. L., 400.  
 Pennington, L. H., 656.  
 Pennington, M. E., 873.  
 Penrose, C. B., 885.  
 Peppin, S. G., 398.  
 Peralta, F. de., 832.  
 Peredo, E., 29.  
 Peren, G. S., 661.  
 Perez, L. M., 693.  
 Perkins, A. E., 468, 572, 580.  
 Perkins, A. J., 885.  
 Perkins, H. Z. E., 11.  
 Perkins, S. O., 618.  
 Perkins, W. R., 174.  
 Perret, C., 350.  
 Perret-Maisonnette, A., 158.  
 Perrot, E., 39.  
 Perry, E. W., 240.  
 Perry, F. R., 234, 652, 654.  
 Petch, C. E., 353.  
 Petch, T., 49, 238.  
 Peter, A., 581.  
 Peterson, A., 455.  
 Peterson, W., 699.  
 Peterson, W. H., 110, 468.  
 Pethybridge, G. H., 200.  
 Petri, A., 88.  
 Petroff, S. A., 80.  
 Pettey, F. W., 155, 357.  
 Pettit, R. H., 496.  
 Pfaender, W. C., 740.  
 Pfenninger, W., 682.  
 Phelan, J., 899.  
 Phillips, A. G., 374, 873.  
 Phillips, C. A., 806.  
 Phillips, E. F., 158.  
 Phillips, E. H., 751.  
 Phillips, H. A., 114.  
 Phillips, J. C., 355.  
 Phillips, S. W., 319.  
 Phillips, V. T., 457.  
 Pl, T. P., 610.  
 Picado, C., 324.  
 Pichard, G., 140, 248.  
 Pichard, M., 205.  
 Piché, G. C., 647.  
 Pichler, F., 345.  
 Pickles, G. W., 885.  
 Pierson, A. H., 41.  
 Pieters, A. J., 435, 740, 829, 830.  
 Piettre, M., 517.  
 Pillai, N. K., 231, 716.  
 Pinchot, G., 240.  
 Pinckney, R. M., 209.  
 Pirquet, C., 567.  
 Pirsch, G. B., 152.  
 Pittman, D. W., 135, 136.  
 Pitts, D. J., 829.  
 Plantefol, L., 245.  
 Plath, O. E., 259.  
 Plough, H. H., 729.  
 Pokrossky, W., 600.  
 Policard, A., 325.  
 Politis, J., 22, 223.  
 Pollacci, 525.  
 Polvogt, L. M., 162.  
 Pomeroy, A. W. J., 755.  
 Pomeroy, C. S., 644.  
 Pommer, E., 817.  
 Pond, G. A., 191, 199, 889.  
 Poole, C. E. L., 743.  
 Poole, R. F., 549, 551, 747, 748, 749.  
 Pope, T. H., 801.  
 Popenoe, C. H., 834.  
 Popoff, K. G., 795.  
 Porsteinsson, P., 795.  
 Porte, W. S., 47.  
 Porter, A., 582.  
 Porter, E. W., 382.  
 Porterfield, W. M., 728.  
 Post, A. H., 900.  
 Potter, A. A., 896.  
 Potter, E. L., 66, 867.  
 Poucher, W. A., 308.  
 Povah, A. H. W., 754.  
 Powell, J. R., 11.  
 Powell, W. W., 795.  
 Power, F. B., 408, 409.  
 Powers, G. F., 61, 262.  
 Powers, W. L., 285, 724.  
 Powick, W. C., 609.  
 Pratapas, D. B., 419.  
 Pratalongo, U., 782.  
 Pratt, E. H., 696.  
 Prentice, D. S., 182.  
 Prescott, J. A., 722.  
 Prescott, W., 400.  
 Price, H. B., 392.  
 Price, J. C. C., 337.  
 Price, W. H., 878.  
 Price, W. J., 313.  
 Pridham, J. T., 438.  
 Primm, J. K., 559.  
 Prince, A. L., 213, 219, 624.  
 Pritchard, F. J., 47.  
 Pritchett, I. W., 787.  
 Prudden, T. M., 180.  
 Pulbrook, E. C., 594.  
 Pullerits, A., 895.  
 Purchas, F. H., 192.  
 Purnell, F. S., 895.  
 Putnam, G. E., 168.  
 Putterill, V. A., 353.  
 Pyle, R., 645.  
 Quastel, J. H., 308.  
 Quesenberry, G. R., 29.  
 Quinn, G., 535.  
 Quintus, R. A., 640.  
 Quirk, A. J., 802.  
 Quisenberry, K. S., 227, 531, 634.  
 Raczkowski, H., 809.  
 Radcliffe, L., 709.  
 Ragsdale, A. C., 177, 278, 466, 467, 474, 578, 781, 874, 875.  
 Rahn, O., 600.  
 Railliet, A., 81.  
 Raines, M. A., 43.  
 Raiziss, G. W., 284.  
 Raju, V. G., 288.  
 Ramaswami Ayyar, C. V., 722.  
 Ramos, R. M., 551.  
 Rand, F. V., 747.  
 Randoin, 62, 166, 465.  
 Rangel, E., 345.  
 Rankin, J. O., 290, 893.  
 Rankin, W. H., 751.  
 Rask, O. S., 500.  
 Rast, L. E., 45.  
 Rathery, F., 864.  
 Ratner, B., 562.

Rau, V., 430.  
 Rauchbaar, G., 681.  
 Ravaz, L., 249, 644.  
 Ravndal, C. M., 744.  
 Read, J. W., 367.  
 Recknagel, A. B., 646.  
 Reddick, D., 650.  
 Reed, C. E., 297.  
 Reed, F. H., 676, 775, 776  
 778.  
 Reed, H. E., 697.  
 Reed, H. S., 317, 327.  
 Reed, O. E., 474.  
 Reed, W. V., 844.  
 Rees, E. C., 412.  
 Rees, R. I., 895.  
 Reeve, L. P., 371.  
 Regeimbal, L. O., 125.  
 Regnier, R., 256.  
 Reid, D. H., 398.  
 Reid, H. A., 76.  
 Reid, J. F. F., 390.  
 Reid, J. S. C., 792.  
 Relly, C., 272.  
 Reinhard, H. J., 759.  
 Reinking, O. A., 148, 656.  
 Reitsma, K., 586.  
 Rejthárek, 832.  
 Remler, R. F., 201.  
 Remy, T., 333.  
 Rennie, T., 77.  
 Rensch, B., 429.  
 Reyes, J. C., 638.  
 Reynolds, B. D., 847.  
 Reynolds, J. B., 893.  
 Reynolds, M. H., 76.  
 Reynolds, R. V., 41.  
 Reznikoff, P., 680.  
 Rhoads, A. S., 96, 753.  
 Rhode, H., 538.  
 Rhodes, F. H., 123.  
 Rhodes, M., 185.  
 Rhumbler, L., 252.  
 Ricard, J. H., 539.  
 Rice, F. E., 178.  
 Rice, J. B., 673.  
 Rich, F. A., 328, 381.  
 Rich, J. H., 192.  
 Richards, B. L., 348.  
 Richardson, A. E. V., 733.  
 Richardson, A. W., 486.  
 Richardson, C. H., 686.  
 Richardson, F. B., 38.  
 Richardson, H. B., 766.  
 Richardson, J. K., 354.  
 Richart, F. E., 385.  
 Richey, F. D., 830.  
 Ricome, H., 127, 225, 326.  
 Riddle, O., 467, 826, 867.  
 Ridge, B. P., 413.  
 Ridley, G. B., 97.  
 Ries, H., 686.  
 Riggs, W. M., 5, 895.  
 Riker, A. J., 42, 745.  
 Riley, J. A., 116, 415.  
 Riley, W. A., 152.  
 Riofrío, B. F., 452.

Ripert, J., 223.  
 Risler, G., 292.  
 Ritchie, A. H., 256.  
 Ritchie, J. H., 433.  
 Ritter, G. J., 712.  
 Ritzman, E. G., 26, 670.  
 Rivalier, E., 78.  
 Rivaz, C. A. G., 345.  
 Rivera, A., 381, 781.  
 Riviére, G., 140, 248.  
 Roadhouse, C. L., 875.  
 Roark, R. C., 196.  
 Robert, S. A., 31.  
 Roberts, J. A. F., 467.  
 Roberts, J. W., 842.  
 Roberts, R. H., 37.  
 Roberts, W. H., 99.  
 Robertson, A., 497.  
 Robertson, G., 474.  
 Robertson, G. R., 201.  
 Robertson, J. G., 79.  
 Robertson, T. B., 569.  
 Robey, O. E., 289.  
 Robins, M. V., 416.  
 Robinson, C. S., 196, 709.  
 Robinson, E. S., 64.  
 Robinson, R. H., 424, 710,  
 834.  
 Robinson, T. R., 38, 543,  
 743.  
 Robinson, W. O., 811.  
 Robison, W. L., 171.  
 Robotka, F., 92.  
 Robson, G. C., 500.  
 Robson, W., 600.  
 Roderick, L. M., 80.  
 Roe, G. C., 77.  
 Roe, H. B., 99, 385.  
 Roelofs, H., 893.  
 Roethe, H. E., 387.  
 Rogers, A., 709.  
 Rogers, O. F., 64.  
 Rogers, T. C., 698.  
 Rohwer, S. A., 359.  
 Rolfs, P. H., 399.  
 Romat, A., 284.  
 Romell, L.-G., 318, 719.  
 Rona, P., 312, 713.  
 Root, C. J., 115.  
 Root, F. M., 259, 358.  
 Root, H. F., 766.  
 Root, R., 893.  
 Root, W. H., 586.  
 Roper, F. A., 293.  
 Rosa, J. T., 15, 536, 741.  
 Rose, J. P., 648.  
 Rose, M. S., 764.  
 Rose, W. C., 664.  
 Rosén, D., 730.  
 Rosen, H. R., 145, 349.  
 Rosenblatt, M., 21, 221.  
 Rosenkrans, D. B., 40.  
 Rosinek, F., 875.  
 Ross, N. M., 344.  
 Ross, W. H., 322.  
 Rosseels, E., 838.  
 Rosset, H., 805.

Rossi, G., 720.  
 Rossi, P., 182.  
 Rost, C. O., 718.  
 Rostovtzeff, M., 891.  
 Rothberg, V. E., 806.  
 Roubaud, E., 455.  
 Rouge, E., 525.  
 Rousseu, B., 79.  
 Roux, 306.  
 Rowan, A. A., 756.  
 Rowlands, M. J., 869.  
 Roy, L., 578.  
 Roy, S. C., 639.  
 Roy, T., 16.  
 Rubattel, 393.  
 Rubel, E., 21.  
 Rubino, P., 863.  
 Rubinstein, E., 807.  
 Ruble, R. O., 483.  
 Rucker, E. H., 528.  
 Ruddick, J. A., 377.  
 Rudolfs, W., 254, 523, 757,  
 821, 888.  
 Ruggles, A. G., 152, 557,  
 754, 755.  
 Rumbold, C., 148.  
 Runner, G. A., 755.  
 Ruppert, F., 584.  
 Ruschka, F., 256.  
 Russell, E. J., 117, 233, 400.  
 Russell F. F., 478.  
 Russell, J., 704.  
 Russell, W. C., 509.  
 Rustin, A. G., 268.  
 Rutgers, A. A. L., 647.  
 Ryder, E. H., 92.  
 Ryerson, K., 342, 644.  
  
 Saari, E., 838.  
 Sablan, E., 434.  
 Saccà, R. A., 143, 248.  
 Sachs-Skalińska, M., 631.  
 Sackett, R. L., 896.  
 Sadler, W., 781.  
 St. George, R. A., 849.  
 St. John-Brooks, R., 185.  
 St. Jonesco, 127, 224, 326.  
 St. Quentin, de, 306.  
 Sakuma, S., 613.  
 Sakurai, E., 63.  
 Salaman, R. N., 336, 737,  
 831.  
 Saldaña, J. A., 533, 539.  
 Sale, J. W., 501.  
 Salmon, E. S., 245, 346.  
 Salter, R. M., 218, 512.  
 Sampson, A. W., 167.  
 Sampson, H. C., 433.  
 Sampson, K., 347, 548.  
 Samuels, L. T., 115.  
 Sanborn, N. W., 375.  
 Sanborn, R., 72.  
 Sanchez, A. C., 672.  
 Sander, F., 814.  
 Sanders, G. E., 346.  
 Sanders, R. S., 544.



## INDEX OF NAMES.

- Aamodt, O. S., 549, 635.  
 Aarnio, B., 15, 722.  
 Abbot, C. G., 209, 314, 509.  
 Abbott, E. V., 620.  
 Abbott, J. F., 755.  
 Abel, J. F., 93, 297.  
 Abry, R., 284, 285.  
 Ackerman, A. J., 558.  
 Ackermann, A. S. E., 86, 87.  
 Ackerson, C. W., 576.  
 Ackert, J. E., 372.  
 Ackley, W. K., 137.  
 Acuña, J., 57.  
 Adam, D. B., 139.  
 Adams, A. J., 484.  
 Adams, J. F., 449.  
 Adams, S. F., 766.  
 Adderley, A., 31.  
 Adkin, R., 156.  
 Aereboe, F., 323.  
 Agafonoff, V., 202, 815.  
 Agar, W. E., 329.  
 Agg, T. R., 886.  
 Agresti, O. R., 89.  
 Ahlson, C. B., 35.  
 Aitken, J., 414.  
 Aitken, R. D., 420, 526.  
 Aiyar, S. S., 206.  
 Ajrekar, S. L., 243.  
 Akerman, A., 744.  
 Åkerman, Å., 246, 738.  
 Albert, D. W., 139.  
 Albertis, S. S., 241.  
 Aidaba, V. C., 434.  
 Alden, C. H., 662.  
 Alderman, W. H., 138.  
 Aldrich, L., 484.  
 Aldrich, L. B., 209.  
 Alexander, G. W., 416, 807, 808.  
 Alexander, W. P., 483.  
 Allan, R. G., 433.  
 Allen, A. H., 413, 615.  
 Allen, A. W., 123.  
 Allen, E., 635, 826.  
 Allen, E. W., 896.  
 Allen, F. M., 766, 767.  
 Allen, H. R., 324.  
 Allen, P. W., 196, 475.  
 Allen, R. F., 839.  
 Allen, W. H., 872.  
 Allison, F. E., 621.  
 Allison, J. H., 543.  
 Allison, R. V., 201, 809.  
 Alpern, D., 565.  
 Alsberg, C. L., 111, 500.  
 Alter, J. C., 808.  
 Altona, T., 354.  
 Alverdes, F., 429.  
 Alway, F. J., 120.  
 Ambler, J. A., 714.  
 Ambrose, A. S., 477.  
 Ambruster, H. W., 851.  
 Amerman, C. H., 876.  
 Ames, C. T., 760, 828.  
 Ames, H. A., 257.  
 Amos, A., 267.  
 Andersen, A. C., 573, 781.  
 Anderson, A. K., 146.  
 Anderson, B. M., 291.  
 Anderson, B. M., Jr., 891.  
 Anderson, E. O., 179.  
 Anderson, E. V., 798.  
 Anderson, F. J., 896.  
 Anderson, G. F., 324, 367.  
 Anderson, M. S., 811.  
 Anderson, P. A., 170.  
 Anderson, P. J., 654.  
 Anderson, R. J., 408, 410.  
 Anderson, S., 489.  
 André, G., 239.  
 Andrew, R. E., 507.  
 Andrews, B. R., 797.  
 Andrews, E. A., 556.  
 Andrews, H. J., 396.  
 Andrews, T. M., 715.  
 Angelis d'Ossat, G. de, 324.  
 Anstead, R. D., 249.  
 Anthony, E. L., 73, 195.  
 Anthony, R. D., 440, 699.  
 Appleman, C. O., 898.  
 Appleton, H. C., 829.  
 Archibald, J. G., 168.  
 Ardern, E., 124.  
 Armentrout, W. W., 194.  
 Armitage, H. M., 663.  
 Armstrong, A. R. V., 88.  
 Armstrong, C., 156.  
 Armstrong, J. K., 840.  
 Armstrong, M. E., 263.  
 Arnaud, F. W. F., 278.  
 Arnd, 511.  
 Arner, G. B. L., 293.  
 Arnett, C. N., 170, 171, 176.  
 Arnhold, F., 212.  
 Arnold, R., 21.  
 Aronson, J. D., 80.  
 Arrhenius, O., 532, 618.  
 Asada, K., 860.  
 Asam, M., 575.  
 Ascoli, V., 600.  
 Ash, E. C., 260.  
 Ashby, A. W., 93, 290.  
 Ashby, J. S., 864.  
 Ashby, S. F., 499, 840.  
 Ashby, W., 99.  
 Ashton, J., 174.  
 Aston, B. C., 815.  
 Asuncion, S., 236.  
 Atherton, C. A., 98.  
 Atkins, W. R. G., 252.  
 Atwater, C. G., 122.  
 Atwater, H. W., 595.  
 Atwood, H., 71, 675.  
 Atwood, W. G., 187.  
 Auchinleck, G. G., 316.  
 Auchter, E. C., 37, 299, 552.  
 Auden, G. A., 855.  
 Aune, R., 170.  
 Austin, G. D., 455.  
 Austin, W. R., 712.  
 Aversa-Saccà, R., 143, 248.  
 Ayers, S. H., 279, 377.  
 Aylesworth, H. M., 99.  
 Aynaud, M., 585.  
 Ayyar, C. V. R., 722.  
 Babcock, C. J., 376, 377.  
 Babcock, E. B., 497.  
 Babson, R. W., 198.  
 Bach, 488, 791.  
 Bachmann, A., 284.  
 Bachmann, F. M., 366, 682.  
 Back, E. A., 53, 56.  
 Bacon, P. E., 96.  
 Badami, V. K., 433.  
 Baer, A. C., 783.  
 Baerg, W. J., 663, 850.  
 Bagley, W. C., 893.  
 Bagué, J., 381.  
 Bailey, C. F., 440.  
 Bailey, C. H., 10, 438, 500, 710.  
 Bailey, D. L., 649, 654, 655.  
 Bailey, E. M., 112, 160, 169, 626.  
 Bailey, I. M., 595.  
 Bailey, J. S., 300.  
 Bailey, L. H., 240.  
 Bailey, P., 84.  
 Bainer, H. M., 533.  
 Baird, A. B., 844.  
 Baird, R. O., 610.  
 Baird, W. W., 440, 533.  
 Baker, A. C., 155, 755.  
 Baker, C. E., 341.  
 Baker, L. V., 367.  
 Baker, M. P., 179.  
 Baker, O. E., 199.  
 Baker, R. P., 898.  
 Baker, S. J., 764.

- Bal, S. N., 146, 148, 150.  
 Balce, S., 309.  
 Balch, W. B., 141.  
 Baldensperger, P.-J., 663.  
 Balderston, L. R., 797.  
 Balduf, W. V., 256.  
 Baldwin, B. T., 853.  
 Balland, A., 561.  
 Ballantyne, S., 469, 470, 472, 573, 592, 817.  
 Ballard, E., 57, 249.  
 Ballard, W. W., 30.  
 Ballore, De Montessus de, 12.  
 Ballou, H. A., 499.  
 Balozet, L., 81.  
 Balls, W. L., 629.  
 Bally, W., 249.  
 Bamer, R. H., 697.  
 Bance, 805.  
 Bancroft, M. J., 358, 359, 455.  
 Banerjee, K. G., 150.  
 Bang, B., 81, 184.  
 Banting, F. G., 766.  
 Barber, H. G., 755.  
 Barber, H. S., 458.  
 Barber, M. A., 559, 758.  
 Barborka, C. J., 766.  
 Barbour, T., 252.  
 Barker, A. F., 695.  
 Barker, J. R., 385.  
 Barnes, I. G., 596.  
 Barnes, P. T., 543.  
 Barnett, C. R., 900.  
 Barnett, E., 65, 68, 70.  
 Barnett, M., 771.  
 Barnett, P. W., 88.  
 Barnette, R. M., 212.  
 Barney, C. O., 161.  
 Barratt, T., 234.  
 Barre, H. W., 399, 696.  
 Barrett, J. T., 750.  
 Barrus, M. F., 653, 749.  
 Barry, D. T., 545.  
 Barss, H. P., 842.  
 Bartels, L. C., 829.  
 Bartholomew, E. T., 752, 753.  
 Bartlett, J. M., 58, 268, 626.  
 Bartoš, V., 832, 833.  
 Barulina, E. I., 231.  
 Basinger, A. J., 553, 657.  
 Bass, C. M., 740.  
 Bassett, H. P., 724.  
 Bassett-Smith, P. W., 865.  
 Bastin, S. L., 314.  
 Basu, N. C., 828.  
 Batchelor, H. W., 203.  
 Batchelor, L. D., 317.  
 Bates, C. G., 344, 807, 808.  
 Batten, H. M., 355.  
 Bauer, F. C., 357.  
 Bauer, K. H., 201.  
 Baughman, W. F., 408.  
 Baumgartel, W. H., 893.  
 Baur, E., 431.  
 Baylor, A. S., 796.  
 Beach, J. R., 871.  
 Beals, C. L., 168.  
 Bear, F. E., 121.  
 Beardsley, H. S., 391.  
 Beattie, H. G., 397.  
 Beattie, J. M., 782.  
 Beaudette, F. R., 383, 685.  
 Beaumont, J. H., 130.  
 Beauverie, J., 244.  
 Beaver, D. C., 182.  
 Becker, E. R., 358, 560.  
 Becker, J. A., 692, 894.  
 Beckley, V. A., 412.  
 Beckwith, T. D., 880.  
 Bédel, 174.  
 Beeson, K., 697.  
 Béguet, M., 249.  
 Belgrave, W. N. C., 50.  
 Bell, A. G., 331.  
 Bell, F. W., 67, 71.  
 Beltrami, P., 284.  
 Belyea, H. C., 646.  
 Bender, C. B., 698.  
 Benedict, F. G., 670.  
 Benjamin, L. P., 96.  
 Bennett, I. D., 139.  
 Bennett, J. S., 577.  
 Bensauade, M., 656.  
 Benson, F. W., 355.  
 Benson, H., 365.  
 Benson, R. L., 79.  
 Benson, T. A., 294.  
 Bensusan, S. L., 892.  
 Bentley, F. L., 869.  
 Bentley, G. M., 849.  
 Benton, T. H., 716.  
 Bergh, O. I., 120, 133.  
 Bergstrand, H., 526.  
 Bernard, P. M., 467.  
 Berry, J. B., 695.  
 Berthault, P., 793.  
 Berthelot, D., 306.  
 Bertrand, G., 21, 221.  
 Besley, F. W., 838.  
 Besley, H. J., 193.  
 Besredka, A., 78.  
 Best, C. H., 260, 712, 767.  
 Betts, A. D., 762.  
 Bevis, A. L., 155.  
 Bewley, W. F., 352, 547.  
 Bews, J. W., 420.  
 Bey, C. A., 512.  
 Beznák, A. von, 859.  
 Bhide, R. K., 23.  
 Bickel, A., 863.  
 Bierry, H., 864.  
 Billings, W. A., 181.  
 Bingham, E. C., 686.  
 Birdsell, R., 887.  
 Birnberg, T. L., 360.  
 Birtwell, C., 413.  
 Bischoff, H. F. L., 412.  
 Bishop, F. C., 482.  
 Bishop, J. E., 587.  
 Bishop, K. S., 60, 163, 261.  
 Bishop, R. O., 452.  
 Bishopp, F. C., 159, 258.  
 Bjanes, O. T., 93.  
 Bjerknes, V., 208.  
 Black, J. D., 193.  
 Blackman, M. W., 453.  
 Blair, A. W., 219, 624.  
 Blair, J. C., 299.  
 Blair, R. J., 754.  
 Blair, T. A., 416.  
 Blair, W. S., 533, 643, 781, 868.  
 Blake, D., 808.  
 Blake, M. A., 543.  
 Blake, S. F., 30.  
 Blanco, G. W., 8.  
 Blaringhem, L., 24, 228, 331, 432.  
 Blaževac, I., 372.  
 Bledisloe (Lord), 792, 794.  
 Bleecker, W. L., 78, 679.  
 Blegvad, O., 772.  
 Blish, M. J., 500, 576.  
 Bliss, C. I., 755.  
 Bloch, E., 23.  
 Blodgett, F. M., 652, 654.  
 Blumenthal, J. L., 764.  
 Blumer, S., 347, 446.  
 Boardman, H. S., 896.  
 Boas, F., 426.  
 Boatman, J. L., 519.  
 Bobilioff, W., 41.  
 Bodenheimer, F., 255.  
 Bodenheimer, F. S., 51.  
 Bodine, J. H., 357.  
 Boerner, E. G., 193.  
 Boerner, F., jr., 383, 584.  
 Boez, L., 882.  
 Bogart, E. L., 792.  
 Bogdanoff, G., 393.  
 Bogdanov-Katjkov, C., 255.  
 Boggs, N., 158.  
 Böhm, C., 724.  
 Bohstedt, G., 170, 573.  
 Boisshot, P., 720.  
 Bolla, G. G., 91.  
 Bolley, H. L., 35.  
 Bolling, G. E., 877.  
 Bolton, F. C., 896.  
 Boman, N., 731.  
 Bonazzi, A., 320, 699.  
 Bond, J. R., 189.  
 Bondar, G., 555, 556.  
 Bonde, R., 96.  
 Bondorff, K. A., 532.  
 Bonnet, E., 221.  
 Bonnett, R. K., 230.  
 Bonnevie, K., 731.  
 Bonnier, G., 530, 730.  
 Boone, F. H., 63, 669.  
 Boothby, W. M., 766.  
 Boquet, A., 284.  
 Bórea, D., 92.  
 Boresch, K., 525, 728.  
 Borrel, A., 882.  
 Bosch, G., 860.  
 Boshnakian, S., 228.  
 Bosman, G. J., 333.  
 Boss, A., 132.



Boswell, V. R., 300.  
 Bouget, J., 324, 427.  
 Boughton, I. B., 383.  
 Bouquet, A. G. B., 834.  
 Bourne, B. A., 351.  
 Bourne, C. L. C., 640.  
 Bowen, J. T., 589.  
 Bower, F. O., 727.  
 Bower, W. T., 709.  
 Bowman, F. H., 831.  
 Bowman, J. J., 149, 239.  
 Bowyer, H., 694.  
 Boyd, G. R., 886.  
 Boyd, W. L., 181, 788.  
 Boynton, W. H., 96.  
 Braak, C., 416.  
 Brackett, R. N., 20.  
 Bradfield, R., 210.  
 Bradfute, O. E., 896.  
 Bradley, J. W., 39.  
 Braham, J. M., 621.  
 Brambell, F. W. R., 825.  
 Branch, F. H., 899.  
 Branch, H. E., 455.  
 Brandt, R. P., 424.  
 Branson, E. C., 493.  
 Branstetter, B. B., 546.  
 Bray, M. W., 715.  
 Breazeale, J. F., 628.  
 Bredemann, G., 335.  
 Bregger, T., 533, 539.  
 Breitenbecher, J. K., 227.  
 Brenchley, W. E., 636.  
 Bressler, R. G., 699.  
 Bressman, E. N., 535, 694.  
 Brethes, J., 53, 661.  
 Brewer, E. P., 137.  
 Brewer, P. H., 726.  
 Bridel, M., 21.  
 Bridge, E., 857.  
 Brierley W. G., 138.  
 Briggs, A. P., 615.  
 Briggs, F. N., 43.  
 Brim, O. G., 494, 893.  
 Brinley, F. J., 608.  
 Brittain, W. H., 844.  
 Brittlebank, C. C., 552.  
 Britton, W. E., 50, 755.  
 Broadhurst, J., 797.  
 Brocq-Rousseu, 79, 584.  
 Brody, S., 278, 466, 467,  
 474, 577, 578, 874.  
 Brooke, H. C., 631.  
 Brooks, A., 355.  
 Brooks, C., 552, 750, 841.  
 Brooks, C. E. P., 416.  
 Brooks, F. D., 374.  
 Brooks, F. E., 662.  
 Brooks, F. T., 763.  
 Brooks, G. B., 386.  
 Brooks, R. St. J., 185.  
 Brosch, A., 536.  
 Brossard, E. B., 291.  
 Broughton, T. H., 178.  
 Brown, A. S., 137.  
 Brown, B. A., 32, 334, 474.  
 Brown, E., 238.

Brown, G. G., 441.  
 Brown, H. D., 300, 725.  
 Brown, N. C., 344.  
 Brown, S. A., 194.  
 Brown, T., 98.  
 Browne, C. A., 196, 197.  
 Browne, H. J., 616.  
 Bruijning, F. F., 237.  
 Brumpt, E., 184.  
 Bruner, S. C., 57.  
 Brunner, E. deS., 494, 794,  
 893.  
 Bruno, 306.  
 Brunson, A. M., 827.  
 Bryan, A. H., 744.  
 Bryan, O. C., 232.  
 Bryant, R. C., 444.  
 Bryant, V. C., 497.  
 Brydon, M. E., 94.  
 Bryson, H. G., 498.  
 Buchanan, D. H., 892.  
 Buchanan, J. H., 712.  
 Buchheim, A., 446.  
 Buckham, 605.  
 Buckingham, B. R., 100.  
 Buckle, P., 253.  
 Buckley, S. S., 883.  
 Buisson, 208.  
 Bull, C. G., 259, 847.  
 Bull, S., 173.  
 Bullis, D. E., 7.  
 Bullock, D. S., 89.  
 Bulmer, L. C., 876.  
 Bunbury, H. M., 587.  
 Burd, J. S., 723.  
 Burd, L. H., 600.  
 Büren, G. von, 630.  
 Bürger, M., 162.  
 Burgess, A. F., 257.  
 Burgess, J. L., 833.  
 Burgess, P. S., 16, 220, 626.  
 Burgwald, L. H., 852.  
 Burhans, C. W., 562.  
 Burkart, F. L., 230.  
 Burke, A. D., 783.  
 Burke, E., 116, 209.  
 Burkle, L. A., 468.  
 Burleigh, T. D., 543.  
 Burleson, G. L., 174.  
 Burnett, J. E., 474.  
 Burnett, W. L., 151.  
 Burns, G. P., 343.  
 Burns, W., 238, 243.  
 Burr, C. G., 896.  
 Burr, W., 893.  
 Burroughs, A. M., 51, 238,  
 441, 541, 542, 657.  
 Burt, B. C., 830.  
 Burt, B. A., 727.  
 Burt, H. J., 389.  
 Bushnell, J., 300.  
 Bushnell, J. W., 138.  
 Bushnell, L. D., 685.  
 Bussard, L., 238.  
 Buston, H. W., 309.  
 Buswell, A. M., 190.  
 Butler, E. J., 244.

Butler, J. F., 243.  
 Butler, O., 710.  
 Butler, O. M., 142.  
 Butterfield, K. L., 498, 893,  
 899.  
 Button, F. C., 476.  
 Buttrick, P. L., 241.  
 Buxton, P. A., 355.  
 Byfield, A. H., 165.  
 Byles, P. G., 93.  
 Byrne, H. A., 493.  
 Cadariu, I., 860.  
 Caesar, L., 346.  
 Cahill, E. A., 481.  
 Calus, J. F., 380.  
 Calder, J. W., 237.  
 Caldwell, O. W., 897.  
 Calkins, L. A., 868.  
 Call, L. E., 298, 533, 538,  
 539, 828.  
 Callander, W. F., 692.  
 Calmette, A., 478, 584.  
 Calvert, H., 795.  
 Calvert, M., 736.  
 Calvino, E. M. de, 640.  
 Cameron, C. J. N., 77.  
 Cameron, S. H., 299, 835.  
 Camp, A. F., 630.  
 Camp, J. C. De, 444.  
 Campanile, G., 439.  
 Campbell, E. G., 439.  
 Campbell, H. C., 186.  
 Campbell, J. H., 453.  
 Campbell, M., 195.  
 Campbell, O. D., 296.  
 Campbell, R. E., 658.  
 Campbell, W. R., 766.  
 Campen, W. H., 586.  
 Campos Novaes, J. de, 459.  
 Cannizzaro, J., 804.  
 Cannon, W. A., 627.  
 Capinpin, J. M., 430.  
 Carazzi, D., 553.  
 Carbone, D., 345.  
 Card, L. E., 373.  
 Carl, 600.  
 Carleton, E. A., 619.  
 Carleton, G. B., 160.  
 Carleton, H. M., 500.  
 Carleton, R., 566.  
 Carlotti, J., 593.  
 Carman, J. S., 867.  
 Carnes, A., 899.  
 Caro, E., 40.  
 Carpenter, C. C., 1.  
 Carpenter, C. D., 82.  
 Carpenter, D. C., 526.  
 Carpenter, P. H., 14.  
 Carr, I. L., 274.  
 Carr, M., 261, 361, 667.  
 Carr, R. H., 726.  
 Carré, H., 684.  
 Carrel, A., 379.  
 Carrero, J. O., 19, 550.  
 Carsner, E., 660.  
 Carter, D. G., 97.

- Carter, H. S., 762.  
 Carter, L. M., 814.  
 Carter, W. H., 575.  
 Cartier d'Yve, L. de, 388.  
 Cartwright, W. B., 559.  
 Carvalho, 415.  
 Carvalhoz, B., 894.  
 Caryl, R. E., 644.  
 Case, H. C. M., 199.  
 Cash, L. C., 747.  
 Casparis, H., 166.  
 Cassin, M., 693.  
 Castle, W. E., 530, 823.  
 Cate, C. C., 807.  
 Cathcart, C. S., 367.  
 Catlin, C. N., 417.  
 Cauchemez, 584.  
 Cavanaugh, G. W., 564.  
 Caverhill, P. Z., 646.  
 Cerighelli, R., 128, 325.  
 Cerleton, E. A., 513.  
 Chabrolin, C., 451.  
 Chace, E. P., 896.  
 Chace, W. G., 86.  
 Chaffin, J., 155.  
 Chamberlain, R., 698.  
 Chamberlin, F. S., 56.  
 Chambers, E. L., 153.  
 Chambers, J. E., 439.  
 Champion, H. G., 40.  
 Chandler, A. C., 482.  
 Chaney, M. S., 563.  
 Channer, F. F. R., 345.  
 Chapman, G. H., 137.  
 Chapman, H. H., 444.  
 Chapman, L. M., 474.  
 Chapman, R. N., 152.  
 Charlan, F., 537.  
 Charters, W. W., 897.  
 Chase, W. W., 453.  
 Chatburn, G. R., 88.  
 Chatley, H., 117.  
 Chatterji, N. G., 801.  
 Chauzit, J., 447.  
 Cheema, G., 249.  
 Cheema, G. S., 38.  
 Chemin, E., 221.  
 Cheplin, H. A., 161.  
 Chesnut, V. K., 408.  
 Chevalier, G., 424.  
 Chiaromonte, A., 31.  
 Chick, H., 567.  
 Childs, L., 441, 844.  
 Childs, R. R., 535.  
 Childs, R. S., 893.  
 China, W. E., 154.  
 Chingo-Chingas, K. M., 337.  
 Chittenden, A. K., 242.  
 Chittenden, D. W., 467.  
 Chittenden, F. H., 32, 57  
 848, 849.  
 Chmelar, F., 737.  
 Chosson, P., 23.  
 Christ, H., 239.  
 Christen, E. M., 699.  
 Christensen, H. R., 724.  
 Christie, A. W., 97.  
 Christie, G. I., 435.  
 Christoph, F. A., 892.  
 Christou, 670.  
 Christy, M., 838.  
 Christy, O. B., 869.  
 Chrysler, M. A., 698.  
 Chrystal, R. N., 556.  
 Chung, H. L., 136.  
 Chupp, C., 653, 749.  
 Church, V. H., 93.  
 Churchill, J. A., 796.  
 Ciferri, R., 142.  
 Ciento, R. W., 260.  
 Clague, J., 231.  
 Clapham, R., 355.  
 Clapp, E. H., 700.  
 Clark, G. H., 238.  
 Clark, J. A. (Canada), 273,  
 368.  
 Clark, J. A. (U.S.D.A.), 33,  
 337, 738.  
 Clark, J. H., 260.  
 Clark, M. B., 727.  
 Clark, O. L., 631.  
 Clark, T., 460.  
 Clarke, G., 28.  
 Clarke, H. T., 709.  
 Clarke, W. T., 538.  
 Clausen, C. P., 459.  
 Clawson, A. B., 77.  
 Clayson, D. H. F., 310.  
 Clayton, E. E., 448, 548.  
 Clayton, H. H., 12.  
 Cleare, L. D., jr., 155.  
 Clegg, G. G., 735, 736, 831.  
 Cleghorne, W. S. H., 86,  
 789.  
 Cleland, J. B., 356.  
 Clemen, R. A., 167.  
 Clemenceau, G., 498.  
 Clemens, C. A., 196.  
 Clement, C. E., 876.  
 Clemente, L. S., 129.  
 Clements, F. E., 627.  
 Cleveland, G. S., 2.  
 Cleveland, L. R., 256.  
 Clibbens, D. A., 413.  
 Clickner, F. H., 473.  
 Cline, C. A., 717.  
 Cloake, P. C., 762.  
 Clopper, E. N., 194.  
 Close, C. P., 300.  
 Clough, H. W., 116.  
 Clyde, H. S., 384.  
 Coad, B. R., 399, 554, 658.  
 Cobb, J. S., 432.  
 Cobb, N. A., 160.  
 Cobb, W. B., 717.  
 Cochran, G. W., 699.  
 Cockerham, K. L., 440.  
 Coe, D. G., 215.  
 Coffey, D. D., 360.  
 Coffey, W. C., 195.  
 Coffman, F. A., 227.  
 Cohen, A., 311.  
 Coker, D. R., 399.  
 Cole, E. W., 593.  
 Cole, F. R., 848.  
 Coleman, L. C., 433.  
 Colin, H., 224.  
 Collazo, J. A., 163, 860, 862,  
 863.  
 Collins, E. J., 23.  
 Collins, E. V., 97, 288.  
 Collins, S. D., 460.  
 Collins, W. O., 814.  
 Collip, J. B., 108, 765.  
 Collison, R. C., 421, 432, 437.  
 Colman, N. J., 2.  
 Comber, N. M., 21, 810.  
 Combes, R., 224, 427.  
 Combs, W. B., 477, 580.  
 Conacher, H. M., 291.  
 Conklin, R. L., 788.  
 Connell, A. B., 318.  
 Conner, A. B., 431, 729.  
 Connor, L. G., 293.  
 Connors, C. H., 39, 300, 543.  
 Conover, M., 696.  
 Conrad, A. M., 691.  
 Conway, W. T., 232.  
 Cook, F. C., 197.  
 Cook, K. M., 194.  
 Cook, L. E., 897.  
 Cook, M. T., 747, 749, 751.  
 Cook, W. C., 846.  
 Cooleage, L. H., 278, 475.  
 Cooley, J. S., 552, 750, 841.  
 Cooley, R. A., 155.  
 Coon, N., 540.  
 Coons, A. T., 724, 820.  
 Coons, G. H., 651.  
 Cooper, E. A., 288.  
 Cooper, E. F., 858.  
 Cooper, F. J., 308.  
 Cooper, H. R., 419.  
 Cooper, T. P., 104, 197.  
 Copeland, J. T., 99.  
 Corbett, G. H., 89.  
 Corkins, C. L., 52, 151.  
 Corley, G. L., 349.  
 Corner, G. W., 531.  
 Corp, C. I., 483.  
 Corson, H. P., 58.  
 Corson-White, E. P., 885.  
 Corwin, E., 766.  
 Cory, E. N., 446.  
 Costa Lima, A. da, 51.  
 Costantin, 225.  
 Costantin, J., 332.  
 Costanzo, G., 93.  
 Cotton, A. D., 350.  
 Cotton, R. T., 457.  
 Cottrell, K. W., 820.  
 Couch, J. F., 77.  
 Couch, L., 844.  
 Coulaud, E., 381.  
 Coulon, A. de, 882.  
 Coulson, J. G., 354, 549.  
 Coulter, J. M., 897.  
 Councilman, W. T., 428.  
 Coupin, H., 125.  
 Cousins, C. W., 93.  
 Cuvreur, E., 23.



- Coverdale, J. W., 99.  
 Covert, R. N., 116, 716.  
 Coville, P., 57.  
 Cowart, R., 735.  
 Cowgill, G. R., 367, 465.  
 Cowles, R. P., 385.  
 Coykendall, C. C., 586.  
 Crabtree, J., 640.  
 Cragg, F. W., 356.  
 Craig, C. E., 232.  
 Cramer, W., 565, 665.  
 Crandall, C. S., 834.  
 Crandall, F. K., 35, 520.  
 Crane, F. G., 798.  
 Cranor, K. T., 297.  
 Crasemann, E., 865, 866.  
 Crawford, A. B., 480.  
 Crawford, C. W., 675.  
 Cray, R. E., 698.  
 Crepps, R. B., 186.  
 Crew, F. A. E., 130, 500, 530, 631, 825.  
 Erichton, A., 172.  
 Crohurst, H. R., 83.  
 Cromley, R. H., 580.  
 Cromwell, S. L., 893.  
 Cross, W. E., 715.  
 Crossley, A. W., 707.  
 Crowther, C., 575.  
 Crozier, W. J., 452.  
 Cruess, W. V., 409, 414.  
 Cruz, C. C., 308.  
 Cruz, S. M., 638.  
 Cubitt, G. E. S., 40.  
 Cullinan, F. P., 341.  
 Cummings, M. B., 342.  
 Cunliffe, P. W., 436.  
 Curie (Mme.), 306.  
 Currier, E. L., 191, 898.  
 Curtis, H. E., 324.  
 Cutright, C. R., 554, 558.  
 Dachnowski, A. P., 321.  
 Dack, G. M., 786.  
 Da Costa Lima, A., 51.  
 Dahl, H. E., 699.  
 Dahlberg, A. C., 477, 782.  
 Dahlberg, G., 731.  
 Dahle, C. D., 179.  
 Dahlgren, B. E., 343.  
 Dakin, H. D., 611.  
 Dakin, W. J., 530.  
 Dale, H. H., 260.  
 Dallimore, W., 344.  
 Dalrymple, G. B., 498.  
 Dalrymple, W. H., 180.  
 Dalrymple-Hay, R., 545.  
 Dalyell, E. J., 567.  
 Damon, S., 664.  
 Damon, S. C., 520.  
 Dana, S. T., 700.  
 Dandeno, J. B., 596.  
 Dangeard, P. A., 222, 223, 427.  
 Danheim, B. L., 372.  
 Daniel, L., 224.  
 Daniels, A. L., 165, 263.  
 Daniels, C. W., 783.  
 Daniels, F., 722.  
 Dann, A. B., 780.  
 Danvig, A. M., 834.  
 Darrow, G. M., 644, 836.  
 Dart, H. M., 493.  
 Dash, J. S., 499.  
 Dassy, A., 582.  
 Dauphiné, A., 225.  
 Davenport, E., 396, 895.  
 Davidson, F. A., 75, 676.  
 Davidson, G., 894.  
 Davidson, J. B., 100.  
 Davidson, L. T., 856.  
 Davies, D. W., 548.  
 Davies, S. H., 442.  
 Davis, A. L., 12.  
 Davis, G. L., 900.  
 Davis, H. P., 580.  
 Davis, K. C., 94, 192.  
 Davis, M. B., 38.  
 Davis, R. L., 335, 398.  
 Davis, W. A., 717.  
 Davis, W. J., 829.  
 Davis, W. R., 670.  
 Davis, W. T., 755.  
 Davison, F. R., 48.  
 Davol, R., 596.  
 Davy, E. D., 746.  
 Day, A. M., 151.  
 Day, W. P., 808.  
 Dayanand, Mamgain, 40.  
 Dean, H. K., 66.  
 de Angelis d'Ossat, G., 324.  
 de Ballore, De M., 12.  
 Débierre, F., 744.  
 de Calvino, E. M., 640.  
 De Camp, J. C., 444.  
 de Campos Novaes, J., 459.  
 de Cartier d'Yve, L., 388.  
 Dechambre, P., 269, 367.  
 Decker, F. N., 676.  
 de Coulon, A., 882.  
 De Dominicis, A., 14.  
 Deeter, E. B., 519.  
 de Forest, H., 315.  
 Degen, A. von, 238.  
 de Gennes, L., 466.  
 Degruilly, L., 451.  
 DeHaan, H. R. M., 39.  
 de Jong, A. W. K., 140.  
 Delafield, F., 180.  
 de la Torre-Bueno, J. R., 755.  
 Delcurto, J. M., 38.  
 Delf, E. M., 64.  
 DeLong, D. M., 755.  
 De Long, W. A., 123.  
 Deluard, H., 223.  
 Demarest, W. H. S., 698.  
 de Mattos, A. T., 359.  
 de Mendivil y Valesco, J. M. D., 832.  
 Demerec, M., 528.  
 Demolon, A., 720, 723.  
 De Montessus de Ballore, 12.  
 Demoussy, E., 126, 327.  
 Denis, W., 569.  
 Densch, A., 625.  
 Denton, M. C., 508.  
 de Ong, E. R., 658, 663.  
 de Peralta, F., 832.  
 De Puy, P. L., 873.  
 de St. Quentin, 306.  
 Descazeaux, J., 455.  
 de Seabra, A. F., 42.  
 Desgrez, A., 864.  
 de Souza, P., 517.  
 Detlefsen, J. A., 129.  
 Detmers, F., 656.  
 Dettweiler, 367.  
 De Turk, E. E., 418.  
 Detwiler, J. D., 57.  
 Devereaux, W. C., 808.  
 de Virville, A. D., 324.  
 de Vries, O., 647.  
 Dewar, D., 252.  
 De Young, W., 617.  
 Diacon, Fonze-, 446.  
 Dice, J. R., 277.  
 Dickey, J. A., 493.  
 Dickhart, W. H., 313.  
 Dickie, F., 275.  
 Dickinson, S., 897.  
 Dicks, A. R., 838.  
 Dickson, B. T., 345, 352, 549, 651.  
 Dickson, E. C., 682.  
 Dickson, J. G., 649, 740.  
 Dickson, R. E., 66.  
 Dickson, W., 509.  
 Dietz, H. F., 659.  
 Dietz, S. M., 43.  
 Dietzius, R., 208, 315.  
 Digges, D. D., 537.  
 Dingler, M., 255.  
 Dixon, H. M., 200.  
 Doane, R. W., 156, 259, 663.  
 Dodd, S., 480, 585.  
 Dodge, B. O., 149, 353, 354.  
 Doerell, E. G., 14.  
 Doidge, E. M., 354, 550.  
 Dolsy, E. A., 635.  
 Dole, R. M., 416.  
 Domínguez, F. A. L., 640.  
 Dominicis, A., de., 14.  
 Donaldson, H. H., 773.  
 Doolittle, R. E., 197.  
 Doolittle, S. P., 651, 748.  
 Doran, W. L., 498.  
 Dorlencourt, H., 772.  
 Dorph-Petersen, K., 237.  
 Dorsey, M. J., 300.  
 d'Ossat, G. de A., 324.  
 Doten, S. B., 78, 896.  
 Dotterrer, W. D., 876, 878.  
 Doucette, C. F., 55.  
 Dougan, W. R., 123.  
 Dougherty, J. E., 497.  
 Douglas, B., 749.  
 Dow, C. H., 386.  
 Dowell, C. T., 468.  
 Downes, J. R., 389.  
 Downs, C. R., 58.  
 Dowson, V. H. W., 39.

- Doyle, L. P., 181.  
 Dozier, C. C., 785.  
 Drabble, J., 586.  
 Dragstedt, L. R., 858.  
 Drain, B. D., 299, 642, 835.  
 Drake, C. J., 453.  
 Drake, E. F., 483.  
 Drechsler, C., 650, 651.  
 Drew, A. H., 565.  
 Driberg, J. C., 316.  
 Driver, L. L., 893.  
 Drost, J., 600.  
 Drummond, J. C., 267, 665.  
 Dschunkovsky, E., 882.  
 Dubin, H. E., 856.  
 Dublin, L. I., 854.  
 DuBois, R. O., 772.  
 Duchene, J. D., 180.  
 Duchoň, F., 222, 507.  
 Duck, R. W., 128.  
 Ducomet, V., 46, 248.  
 Dudley, H. W., 260.  
 Duffau, A., 869.  
 Duffee, F. W., 98, 589, 687, 799.  
 Dufour, 225.  
 Dufrénoy, J., 326, 661.  
 Duggar, B. M., 840.  
 Dühring, F., 724.  
 Duke, W. W., 262.  
 Duley, F. L., 15.  
 Dunbar, C. O., 498.  
 Dungan, G. H., 650.  
 Dunlavy, H., 633.  
 Dunlop, W. R., 499.  
 Dunn, L. C., 227, 374, 577, 631, 731.  
 Dunn, L. H., 53, 55, 359, 556.  
 Dunn, W. E., 887.  
 Dunning, D., 241.  
 Du Pasquier, R., 836.  
 Durand, H., 240.  
 During, A., 895.  
 Durrell, L. W., 145, 548.  
 Dustan, A. G., 844.  
 Dutcher, R. A., 411, 463, 472, 564.  
 Dutt, G. R., 58.  
 Dutt, S., 40.  
 Dutton, W. C., 300.  
 Dyar, H. G., 661.  
 Dye, H. W., 651.  
 Dyer, E., 695.  
 Dyssegaard, A., 277.  
 d'Yve, L. de C., 388.  
 Eadie, G. S., 461.  
 Earnshaw, F. L., 150, 252, 355.  
 Easterwood, H. W., 424, 521, 723, 818.  
 Eastham, A., 367.  
 Eastham, J. W., 249.  
 Eaton, B. J., 319.  
 Eaton, O. N., 527.  
 Eaton, T. H., 795, 897.  
 Ebeling, A. H., 379.  
 Eckerson, S. H., 839.  
 Eckl, K., 233, 818.  
 Eckles, C. H., 175, 577.  
 Eckstein, F., 255.  
 Eddy, E., 651.  
 Eddy, H. P., 590.  
 Eddy, W. H., 898.  
 Edgar, G., 308.  
 Edgington, B. H., 582.  
 Edick, G. L., 388.  
 Edler, W., 439.  
 Edmonds, J. L., 396, 675.  
 Edson, H. A., 21.  
 Edwards, H., 895.  
 Edwards, J. T., 480.  
 Edwards-Ker, D. R., 574.  
 Ehrenberg, P., 817.  
 Ekblaw, K. J. T., 97.  
 Elder, C., 381.  
 Elford, F. C., 777.  
 Eliot, W. A., 843.  
 Ellenberger, W., 76.  
 Ellington, E. V., 276.  
 Elliott, C., 550.  
 Elliott, E. E., 394.  
 Elliott, F. A., 647.  
 Elliott, G. R. B., 798.  
 Elliott, J. A., 145, 748.  
 Ellis, L. M., 545.  
 Ellis, S. C., 871.  
 Elschner, C., 709.  
 Elwell, J. A., 519.  
 Ely, R. T., 199.  
 Emberger, L., 223.  
 Emerson, R. A., 24.  
 Emmett, A. D., 373.  
 Engels, O., 423, 619.  
 Engledow, F. L., 27.  
 Enns, P. W., 533.  
 Erdman, H. E., 197.  
 Eredia, F., 718.  
 Eriksen, S., 884.  
 Eriksson, J., 150, 250.  
 Ernle (Lord), 792.  
 Esguerra, F., 638.  
 Eskridge, J. R., 551.  
 Espino, R. B., 436, 638.  
 Essenberg, J. M., 331.  
 Essig, E. O., 838, 845.  
 Estioko, R. P., 832.  
 Evans, A. C., 183, 878.  
 Evans, F. A., 806.  
 Evans, H. M., 60, 163, 261.  
 Evans, N. S., 144, 649.  
 Evenden, J. C., 756.  
 Evers, N., 611.  
 É Vlieberg, 891.  
 Evrard, E., 359.  
 Evvard, J. M., 64, 172.  
 Ewing, H. E., 762, 851.  
 Eyer, J. R., 755.  
 Ezekiel, M., 689.  
 Ezekiel, W. N., 148, 451, 842.  
 Ezendam, J. A., 468.  
 Faber, H. K., 854.  
 Fabian, F. W., 496, 580.  
 Fabre, A., 253.  
 Fabre, J. H., 151, 359.  
 Fabry, 208.  
 Faes, H., 457.  
 Fain, J. R., 199.  
 Fairfield, W. H., 269, 271, 272.  
 Fairhall, L. T., 613.  
 Falck, F., 93.  
 Falconer, J. I., 199, 200, 294, 594.  
 Fallada, O., 833.  
 Fantham, H. B., 518.  
 Farabaugh, C. L., 125.  
 Farbrother, E. S., 479.  
 Farley, A. J., 300.  
 Fascetti, G., 780.  
 Fauchère, A., 637.  
 Faulkner, O. T., 828.  
 Faull, J. H., 753.  
 Faure, J. C., 257, 851.  
 Favary, E., 287.  
 Fawcett, E. H., 802.  
 Fawcett, H. S., 752.  
 Fay, A. C., 180.  
 Featherstone, 735.  
 Feldman, H. W., 430.  
 Feldstein, L., 196.  
 Fell, H. B., 227, 500, 530.  
 Fellenberg, T. von, 608, 865.  
 Fellers, C. R., 200.  
 Felt, E. P., 51.  
 Fensch, 890.  
 Fenton, E. W., 878.  
 Fenton, F. A., 154.  
 Fenton, F. C., 99.  
 Ferguson, B., 385.  
 Ferguson, J. A., 485.  
 Fernish, C. A., 79.  
 Fernow, K., 652.  
 Ferraz, S., 13, 415.  
 Ferrer, L. G., 638.  
 Ferrin, E. F., 169.  
 Ferris, E. B., 38.  
 Ferris, G. F., 558.  
 Ferris, I. W., 805.  
 Ferris, L. W., 476.  
 Ferrouillat, 588.  
 Ferry, R. M., 823.  
 Fetherolf, N. J., 150.  
 Feytaud, J., 661, 758, 846.  
 Fick, R., 431.  
 Fieger, E. A., 718.  
 Field, A. M., 297.  
 Fieldner, A. C., 387.  
 Filho, A. T., 596.  
 Filipović, S., 280.  
 Filley, H. C., 594.  
 Findlay, D. M., 611.  
 Findlay, G. M., 770, 859.  
 Finesilver, E. M., 684.  
 Finks, A. J., 64.  
 Finlay, G. F., 870.  
 Fischer, A. F., 344.  
 Fischer, G., 589, 687.



- Fisher, D. F., 552, 749, 750, 751, 841.  
 Fisher, E. A., 812.  
 Fisher, F. A., 418.  
 Fisher, G. J., 893.  
 Fisher, N. F., 864.  
 Fisher, R. A., 234.  
 Fisher, R. C., 378.  
 Fisk, W. W., 680.  
 Fiske, J. G., 740.  
 Flitch, C. P., 175, 181.  
 Fitch, W. Q., 390.  
 Fitschen, F., 96.  
 Flitts, P. I., 486.  
 Fitz, L. A., 65, 77.  
 Fitz, R., 766.  
 Fitzpatrick, H. M., 549.  
 Fitzsimons, F. W., 252.  
 Flanagan, C. M., 695.  
 Fleck, L. C., 712.  
 Fleming, W. E., 56.  
 Flemington, C. N., 395.  
 Flenner, A. L., 16.  
 Flerov, B. K., 347.  
 Fletcher, A. A., 766.  
 Fletcher, A. B., 484.  
 Fletcher, L. J., 97, 100.  
 Flint, H. R., 807, 808.  
 Flint, O. S., 383.  
 Flint, W. P., 357.  
 Florián, C. A., 639.  
 Floyd, C., 381.  
 Foëx, E., 449, 550.  
 Fohrman, M. H., 578.  
 Folks, G. H., 194.  
 Folsom, D., 46, 350, 653.  
 Fonda, M., 600.  
 Fonzes-Diacon, 446.  
 Foord, J. A., 96.  
 Foote, F., 94.  
 Foote, W. A., 744.  
 Forbes, C. N., 727.  
 Forbes, E. B., 266.  
 Forbes, S. A., 553.  
 Forel, A., 260.  
 Foreman, E. C., 373.  
 Forest, H. de, 315.  
 Formad, R. J., 883.  
 Forssblad, N., 388.  
 Fortier, S., 99.  
 Fosse, R., 224.  
 Foster, C. H., 744.  
 Foster, G. L., 108.  
 Foster, L. D., 438.  
 Foster, W. A., 97.  
 Fourest, E., 285.  
 Fowle, F. E., 209.  
 Fox, E. J., 204.  
 Fox, H., 885.  
 Fox, H. D., 466.  
 Fox, H. M., 510.  
 Frame, N. T., 893.  
 France, L. V., 152.  
 Francis, W., 134.  
 Frank, A., 195, 598, 844.  
 Frank, L. C., 876.  
 Franklin, H. J., 656, 659.  
 Fraps, G. S., 118, 220.  
 Fraser, M., 693.  
 Frear, W., 95, 237.  
 Fred, E. B., 110.  
 Frederick, W. J., 752.  
 Fredholm, O., 885.  
 Freeborn, S. B., 82.  
 Freedman, L., 564, 763.  
 Freeland, E. C., 499.  
 Freeman, H. A., 537.  
 Frehafer, M. K., 714.  
 French, A. P., 341, 642.  
 French, G. T., 740.  
 French, W. H., 599.  
 Freudling, O., 255.  
 Freund, J., 583.  
 Frevert, H. W., 688.  
 Frey, J. J., 692, 876.  
 Friday, D., 89, 691.  
 Friede, M., 576.  
 Friederichs, K., 249.  
 Frisak, A., 636.  
 Froggatt, W. W., 256.  
 Froidevaux, J., 713.  
 Fromme, F. D., 144, 750.  
 Fronda, F. M., 872.  
 Frost, S. W., 454.  
 Frothingham, E. H., 240.  
 Fry, W. H., 811.  
 Fryer, J. C. F., 53.  
 Fryer, P. J., 356.  
 Fudge, B. R., 698.  
 Fuertes, A. G., 355.  
 Fullaway, D. T., 657.  
 Fuller, J. W., 586, 685.  
 Fuller, R. G., 194.  
 Fulmer, E. I., 362, 768, 769, 853.  
 Fulmer, H. C., 161.  
 Fulmer, H. L., 255.  
 Fulton, H. R., 149.  
 Fulton, J. S., 880.  
 Funk, C., 61, 506, 564, 763, 856.  
 Funkhouser, W. D., 755.  
 Funkquist, H., 731.  
 Furness, R., 287.  
 Furst, A., 201.  
 Fuwa, T., 535.  
 Gaarder, T., 722.  
 Gadd, C. H., 57, 242.  
 Gage, G. E., 383.  
 Gahan, A. B., 260, 851.  
 Gain, E., 325.  
 Gaines, V. C., 693.  
 Gaines, W. L., 75, 676.  
 Gallagher, B. A., 788.  
 Galpin, C. J., 492, 893.  
 Gandhi, S. R., 38.  
 Gandy, J. M., 499.  
 Gannon, A. F., 486.  
 Gansser, A., 560.  
 Garber, R. J., 531, 634.  
 Gardiner, R. S., 192.  
 Gardner, A. K., 654.  
 Gardner, C., 92.  
 Gardner, F. D., 424.  
 Gardner, G. H., 282.  
 Gardner, M. W., 249, 655, 750.  
 Gardner, W., 384.  
 Garman, P., 50, 851.  
 Garnett, M., 380.  
 Garola, J., 612.  
 Gascoyne, W. J., jr., 220.  
 Gaskell, W. H., 683.  
 Gasser, G. W., 533.  
 Gates, F. L., 897.  
 Gault, L., 324.  
 Gaunt, P., 124.  
 Gautier, C., 556.  
 Gavarra, P., 638.  
 Gébhart, J. C., 854.  
 Geddes, 825.  
 Gehring, A., 721, 814, 817.  
 Geiger, J. C., 365, 569.  
 Geilmann, 817.  
 Geldard, W. J., 204.  
 Gennes, L. de, 466.  
 Gentry, C. E., 394.  
 Genung, A. B., 198.  
 Georgeson, C. C., 140, 532, 539, 597, 787.  
 Georgi, C. D. V., 319.  
 Gericke, M. L., 895.  
 Gericke, W. F., 326, 525.  
 Gerry, E., 656.  
 Gersdorff, C. E. F., 711.  
 Gerstenberger, H. J., 59.  
 Getty, R. E., 539.  
 Geyelin, H. R., 766.  
 Ghosh, C. C., 51, 153.  
 Ghosh, D. N., 693.  
 Gibbons, C. E., 194.  
 Gibbs, W. M., 203.  
 Gibson, A., 454.  
 Gibson, K. S., 714.  
 Gieseke, L. F., 209.  
 Giffard, W. M., 756.  
 Gilbert, A. H., 147, 652.  
 Gilbert, H. C., 137.  
 Gilbert, W. W., 834.  
 Gilchrist, D. A., 134.  
 Gile, P. L., 19, 811.  
 Giles, U., 569.  
 Gill, W., 545.  
 Gillette, C. P., 151.  
 Gillette, J. M., 893.  
 Gillin, J. L., 893.  
 Gilman, D. C., 605.  
 Gilmer, P. M., 755.  
 Giltner, W., 411.  
 Girard, H., 191.  
 Giraud, F., 820.  
 Girola, C. D., 29.  
 Gisborne, H. T., 544.  
 Gist, F. W., 298.  
 Glung, N. T., 23.  
 Glaser, R. W., 259, 456, 560.  
 Glatfelter, G. V., 172.  
 Gleisberg, W., 643.  
 Glenny, A. T., 783.  
 Glover, G. H., 684.

- Glover, J. J., 877.  
 Godbout, A. P., 535.  
 Godden, W., 161.  
 Godfrey, G. H., 142, 145, 754.  
 Goefghebuer, M., 358.  
 Gokhale, V. G., 28.  
 Goldbeck, A. T., 789, 886.  
 Goldberg, S. A., 479, 869.  
 Goldberger, J., 284, 586, 669.  
 Goldblatt, H., 264, 265, 666, 667, 771.  
 Golding, F. D., 755.  
 Golding, J., 267.  
 Goldschmidt, R., 226, 430, 530, 825.  
 Goldschmidt, V. M., 521.  
 Gonzaga, L., 309.  
 Gonzalez, B. M., 824, 872.  
 Goodale, H. D., 577.  
 Goodell, C. J., 65, 68, 70.  
 Gooderham, C. B., 561.  
 Goodwin, O. T., 475.  
 Gordon, N. E., 16, 213.  
 Gore, H. C., 196, 711.  
 Gorham, R. P., 844.  
 Goris, A., 223.  
 Gortner, R. A., 125, 137, 500, 502, 503, 504.  
 Goss, H., 342.  
 Goss, W. L., 740.  
 Gossard, H. A., 553.  
 Gossman, S. S., 497.  
 Gourley, J. H., 299, 834.  
 Gouwens, W. E., 569.  
 Gowdey, C. C., 556.  
 Gowen, J. W., 37, 74, 178.  
 Gower, G. C. L., 544.  
 Grabow, R. H., 142.  
 Grafe, V., 427.  
 Graham, R., 383.  
 Graham, S. A., 152, 360, 755, 845.  
 Grammont, A., 9.  
 Grandeau, L., 306.  
 Grant, G. B., 687.  
 Grant, S. B., 766.  
 Graper, F. M., 855.  
 Gratia, A., 881.  
 Gray, D. T., 896.  
 Gray, H., 766.  
 Gray, H. I. A., 343.  
 Gray, L. C., 200.  
 Gray, R. A. H., 55.  
 Greaves, J. E., 119, 526.  
 Greeley, W. B., 141, 837.  
 Green, E. E., 155.  
 Green, G. S., 740.  
 Green, H. W., 847.  
 Green, R. M., 392.  
 Green, T. C., 699.  
 Greenbank, G. R., 204, 713.  
 Greene, J. H., 897.  
 Greene, T. W., 888.  
 Greenstreet, V. R., 452.  
 Greenwald, A., 893.  
 Greenwood, A. W., 329.  
 Gregg, W. R., 314.  
 Gregory, C. T., 748.  
 Greppi, E., 600.  
 Griffee, F., 246.  
 Griffin, E. L., 554.  
 Griffith, J. J., 324.  
 Griffith, J. P., 36.  
 Grimes, M., 476, 853.  
 Grimes, M. F., 469.  
 Grimes, W. E., 593.  
 Grimmer, W., 176, 600.  
 Grisch, A., 444.  
 Groenewege, J., 347.  
 Groff, C. G., 154.  
 Gross, A. O., 553.  
 Gross, E. R., 90, 99, 791.  
 Gross, G., 890.  
 Gross, L., 668.  
 Grossfeld, J., 614.  
 Grube, W. M., 657.  
 Grunsky, C. E., 385.  
 Guberlet, J. E., 788.  
 Guérin, P., 428.  
 Güettler, A., 852.  
 Guillaumin, 466.  
 Guilliermond, A., 23, 125, 222.  
 Gujar, K. B., 28.  
 Gulik, D. van, 208.  
 Gullickson, T. W., 175.  
 Gustafson, A. F., 815.  
 Gustafson, R. K., 282.  
 Guthier, E. H., 414.  
 Guthrie, E. S., 679.  
 Gutman, M., 772.  
 Gutsell, J. S., 709.  
 Guy, R. A., 262, 263.  
 György, P., 609.  
 Haag, J. R., 411.  
 Haas, A. R. C., 327.  
 Haas, G. C., 198, 392.  
 Haasis, F. W., 142, 444.  
 Hacker, H., 359.  
 Hackleman, J. C., 357.  
 Hadden, F., 854.  
 Haden, R. L., 112.  
 Hadwen, S., 400, 453, 880.  
 Haecker, T. L., 466.  
 Haenseler, C. M., 751.  
 Hagem, O., 722.  
 Hahn, G. G., 753.  
 Haigh, L. D., 626, 821, 868.  
 Hale, H., 679.  
 Haley, D. E., 19.  
 Hall, A. D., 693.  
 Hall, C. J. J. van, 548.  
 Hall, F. P., 417.  
 Hall, I. C., 411.  
 Hall, J. S., 564.  
 Hall, M. C., 684.  
 Hall, N., 872, 873.  
 Hall, T. D., 218.  
 Halligan, C. P., 442.  
 Halnan, E. T., 266.  
 Halstead, E. W., 38.  
 Halstead, H. F., 38.  
 Halverson, J. O., 169.  
 Ham, E. S., 174.  
 Hamil, J. M., 580.  
 Hamilton, J., 395.  
 Hamilton, R. I., 432.  
 Hamlin, J. C., 558.  
 Hammer, B. W., 109, 179.  
 Hammett, F. S., 774.  
 Hammond, A. A., 552.  
 Hammond, J. W., 270.  
 Hammond, R. L., 178.  
 Hancock, H. A., 629.  
 Handovsky, H., 709.  
 Hanley, R. E., 393.  
 Hannaford, I. J., 574.  
 Hannas, R. R., 473.  
 Hansen, A. A., 181, 641, 740.  
 Hansen, T. S., 49, 443, 544.  
 Hansford, C. G., 551, 763, 840.  
 Hansson, N., 673, 777.  
 Hanstein, R. von, 554.  
 Hara, S., 856.  
 Haralson, C., 140.  
 Harcourt, R., 717.  
 Harden, A., 806.  
 Harding, H. A., 875, 876.  
 Harding, L., 280.  
 Harding, P., 257.  
 Hardison, A. C., 93.  
 Hardy, F., 499.  
 Hardy, F. W., 266.  
 Hare, H. R., 592.  
 Hargitt, C. W., 257.  
 Hargreaves, H., 555.  
 Haring, C. M., 497.  
 Harkey, F. L., 593.  
 Harlan, J. D., 421, 432, 437.  
 Harland, S. C., 499, 632, 732, 735, 736, 831.  
 Harler, C. R., 14, 419.  
 Harold, C. H. H., 559.  
 Harper, J. N., 399.  
 Harper, M. W., 174.  
 Harreveld, J. van, 32.  
 Harrington, F. M., 135, 139.  
 Harrington, J. B., 828.  
 Harris, D. G., 686.  
 Harris, F. S., 135, 136.  
 Harris, J. A., 275.  
 Harris, J. P., 112.  
 Harris, L. J., 802.  
 Harris, W. R., 186.  
 Harrison, J. B., 134, 640.  
 Harrop, G., 766.  
 Harrow, B., 506, 769.  
 Harshaw, H. M., 163, 175.  
 Hart, E. B., 362, 678, 780.  
 Hart, G., 196.  
 Hart, G. H., 788.  
 Hart, R. A., 886.  
 Harter, L. L., 21, 45, 648, 749.  
 Hartley, E. A., 151, 559.  
 Hartman, C., 636.



- Sanderson, D., 492.  
 Sanderstrom, W. M., 47.  
 Sando, C. E., 7.  
 Sando, W. J., 641.  
 Sanford, M. R., 116.  
 Sapiro, A., 893.  
 Sarasola, S., 808.  
 Sarkar, B. N., 536.  
 Sasscer, E. R., 845.  
 Sasse, A. R., 500.  
 Sato, M., 876.  
 Saucken, S. von, 724.  
 Saunders, A. R., 425.  
 Saunders, C. B., 238, 338.  
 Saunders, C. E., 231.  
 Savage, A., 681.  
 Savage, W. G., 378.  
 Savarensky, F. P., 600.  
 Savastano, G., 342, 743.  
 Savin, W. H., 271.  
 Savin, W. M., 359.  
 Savron, L., 434.  
 Sawyer, G. G., 73.  
 Sax, K., 26, 27, 37, 300.  
 Saye, E. B., 284, 586.  
 Scammon, R. E., 868.  
 Schäfers, J., 17.  
 Schaffnit, E., 245.  
 Schalk, A. F., 80.  
 Schegalow, S., 32.  
 Scheidter, F., 256.  
 Schermerhorn, L. G., 36, 300.  
 Schertz, F. M., 713.  
 Schickfus, E. von, 575.  
 Schilling, S. J., 78.  
 Schippel, H. F., 486.  
 Schleich, G., 379.  
 Schlick, W. J., 586.  
 Schmidt, C. C., 796.  
 Schmidt, C. L. A., 108.  
 Schmidt, D., 134.  
 Schmidt, E. G., 110.  
 Schmidt, L. B., 690, 691.  
 Schneck, H. W., 300.  
 Schneider, H., 626.  
 Schneider, M., 631.  
 Schneidewind, W., 235.  
 Schoening, H. W., 883.  
 Scholer, C. H., 484.  
 Scholl, G. J., 53.  
 Schollenberger, J. H., 738.  
 Schollmayer-Lichtenberg, F. von, 255.  
 Schönbrunn, B., 516.  
 Schopmeyer, C. H., 394.  
 Schoppe, W. F., 73, 871.  
 Schorger, A. W., 509.  
 Schotte, G., 837.  
 Schrader, A. L., 300.  
 Schrader, F., 731.  
 Schrero, M., 615.  
 Schreuder, P. J. v. d. H., 367.  
 Schribaux, 247.  
 Schroeder, E. C., 878.  
 Schryver, S. B., 309, 310, 782.  
 Schuckmann, W. von, 255.  
 Schultz, E. S., 46, 653.  
 Schuster, G. L., 18.  
 Schutte, W. M., 587.  
 Schwappach, 621.  
 Schwartz, E. W., 111.  
 Schwitalla, A. M., 385.  
 Scott, C. E., 447.  
 Scott, D. A., 260, 712, 767.  
 Scott, E. K., 722.  
 Scott, J. M. D., 262.  
 Scott, J. P., 682.  
 Scott, R. D., 204.  
 Scott, W. E., 880.  
 Seabra, A. F. de, 42.  
 Seal, J. L., 148.  
 Sealy, S. T., 50.  
 Seaman, W., 196.  
 Sears, F. C., 140.  
 Sears, H. J., 79.  
 Seddon, H. R., 584.  
 Seese, P., 599.  
 Séguy, E., 758.  
 Seidenberg, A., 201.  
 Seifn, F., jr., 661.  
 Seligman, R., 782.  
 Sell, M. T., 362, 363, 364.  
 Selvig, C. G., 120.  
 Semple, A. T., 573.  
 Senior-White, R., 156.  
 Sergeant, E., 249.  
 Serrano, F. B., 549.  
 Setchell, W. A., 236.  
 Severac, M., 284.  
 Severin, H. H. P., 660.  
 Seward, H. L., 586.  
 Shaffer, P. A., 361.  
 Shambhoo Dutt, 40.  
 Shamel, A. D., 644, 833.  
 Shapovalov, M., 653, 840.  
 Sharma, L. C., 28.  
 Sharp, P. F., 500, 502, 503, 504.  
 Sharpe, J. F., 39.  
 Sharples, A., 49, 250, 447.  
 Shaw, J. K., 631, 642.  
 Shaw, R. H., 109, 279.  
 Shaw, R. S., 496.  
 Shaw, W. M., 522, 523, 819.  
 Shchukin, D., 600.  
 Shead, A. C., 218.  
 Sheather, A. L., 480.  
 Shedd, O. M., 203.  
 Sheehy, E. J., 579.  
 Sheets, E. W., 190, 774.  
 Sheets, O., 61.  
 Shepard, H. H., 116, 510, 809.  
 Sheppard, S. E., 12.  
 Shepperd, J. H., 67.  
 Sherbakoff, C. D., 648, 843.  
 Sherfy, C. B., 73.  
 Sheridan, M. E., 896.  
 Sherier, J. M., 808.  
 Sherman, F., 57.  
 Sherman, H. C., 60, 611, 898.  
 Sherman, J. M., 109, 205, 279.  
 Sherrard, E. C., 8.  
 Sherrill, J. W., 766.  
 Sherwin, M. E., 321, 699.  
 Sherwood, F. F., 109.  
 Sherwood, R. C., 10.  
 Sherwood, S. F., 206, 509, 744.  
 Shevsky, R., 682.  
 Shigley, J. F., 699.  
 Shillinger, J. E., 684.  
 Shimer, S. R., 411.  
 Shipley, P. G., 166.  
 Shive, J. W., 201, 212.  
 Shohl, A. T., 664.  
 Shoup, G. R., 175, 598.  
 Shoup, (Mrs.) G. R., 175, 195, 598.  
 Show, S. B., 645, 807, 808.  
 Shri Kent, S. S., 786.  
 Shuck, C., 263.  
 Sibley, F. H., 896.  
 Sibley, J. C., 376.  
 Sidenius, E., 237.  
 Sierp, 791.  
 Sikorsky, L., 381.  
 Silkett, R. J., 697.  
 Silvestri, F., 554.  
 Simkins, W. A., 699.  
 Simmonds, N., 61, 162.  
 Simmons, P., 850.  
 Simola, E. F., 533.  
 Simon, C. E., 78.  
 Simon, J., 737.  
 Simon, L., 792.  
 Simon, L. J., 202.  
 Simpson, D. M., 30.  
 Simpson, J. S., 268.  
 Simpson, S., 275, 868.  
 Simpson, S. G., 805.  
 Singh, T. P., 647.  
 Sirrine, E. F., 740.  
 Sjogren, J. W., 388.  
 Sjollem, B., 570.  
 Skalinska, M. S., 631.  
 Skinner, J. H., 369.  
 Skinner, W. W., 197.  
 Skouby, C. I., 268.  
 Skuderna, A. W., 336.  
 Slagg, C. M., 749.  
 Slanetz, E. J., 62.  
 Slate, W. L., jr., 32, 334, 474.  
 Slaughter, B. G., 724.  
 Slipper, J. A., 123.  
 Slocum, R. R., 72, 873.  
 Slogteren, E. van, 452.  
 Slosson, E. E., 897.  
 Slovitzov, B., 561.  
 Smales, C. B., 242.  
 Smit, B. J., 279, 714.  
 Smith, C. B., 893.  
 Smith, C. M., 525.  
 Smith, C. O., 752, 753.  
 Smith, C. R., 498.  
 Smith, C. S., 366.

- Smith, C. W., 100.  
 Smith, D. N., 562.  
 Smith, E. H., 447.  
 Smith, F. H., 838.  
 Smith, G. A., 698.  
 Smith, G. H., 584.  
 Smith, H. A., 240.  
 Smith, H. H., 265, 272, 568.  
 Smith, H. S., 657, 661.  
 Smith, J. B., 626.  
 Smith, J. F., 893.  
 Smith, J. R., 199.  
 Smith, L. J., 687.  
 Smith, M. A., 293.  
 Smith, M. R., 664.  
 Smith, P. H., 168, 774.  
 Smith, P. W. B., 865.  
 Smith, R. E., 52.  
 Smith, R. S., 876, 877.  
 Smith, R. W., 323, 337, 639.  
 Smith, T., 479, 883.  
 Smith, W., 765.  
 Smith, W. D., 193.  
 Snapp, O. I., 155, 662.  
 Snell, M. G., 65.  
 Snell, W. H., 753, 754.  
 Snelson, W. H., 828.  
 Snider, H. J., 418.  
 Snow, W. G., 589.  
 Snyder, R. M., 411.  
 Snyder, T. E., 659.  
 Snyder, W. P., 533, 539.  
 Soames, K. M., 265, 666, 667.  
 Sokolovskii, A. N., 317.  
 Sokolowska, Z., 174.  
 Sola, T., 419.  
 Sommer, H., 680.  
 Sommer, H. H., 279, 783.  
 Soparkar, M. B., 281.  
 Soper, W. B., 584.  
 Sorber, D. G., 196.  
 Sörensen, S., 296.  
 Soskin, S. E., 792.  
 Souba, A. J., 473, 779.  
 Soule, R. M., 814.  
 Soule, R. P., 485.  
 South, F. W., 42, 89, 251.  
 Souza, P. de, 517.  
 Spanton, W. T., 694.  
 Sparhawk, W. N., 141.  
 Sparn, E., 208.  
 Spaulding, P., 656.  
 Spencer, C. J., 599.  
 Spencer, G. L., 11.  
 Spencer, H., 843.  
 Speyer, E. R., 454.  
 Spiegel, L., 880.  
 Spillman, W. J., 199, 590.  
 Springer, E. M., 493.  
 Spurway, C. H., 617.  
 Stackhouse, H. M., 20.  
 Stackhouse, W. H., 96.  
 Staehelin, M., 457.  
 Stäger, R., 545.  
 Stahl, C. F., 660.  
 Stakman, E. C., 49, 143, 144, 148, 175, 549.  
 Stambaugh, V. G., 372.  
 Stammers, A. D., 60.  
 Staněk, V., 400.  
 Stanfield, R., 287.  
 Stanford, E. E., 746.  
 Stang, A. H., 888.  
 Stanley, L., 896.  
 Stanton, T. R., 227, 822.  
 Stapledon, R. G., 93.  
 Starin, W. A., 682, 786.  
 Stark, H. H., 259.  
 Starkey, L. V., 496.  
 Starkey, R. L., 517, 620, 698.  
 Starr, L. E., 882.  
 Starring, C. C., 300.  
 Staton, W. C., 700.  
 Stead, A., 774.  
 Stear, J. R., 660.  
 Stearns, L. A., 755.  
 Stebut, A. I., 232.  
 Steeg, T., 193.  
 Steel, T., 833.  
 Steele, B. D., 639.  
 Steenbock, H., 362, 363, 364, 678, 765, 780.  
 Steffen, M., 600.  
 Stein, L., 792.  
 Steiner, G., 251.  
 Stenton, R., 53.  
 Stephenson, H. D., 462.  
 Stephenson, R. E., 322.  
 Stevens, F. L., 727.  
 Stevens, J. S., 13.  
 Stevens, N. E., 48.  
 Stevens, O. A., 35, 439, 740.  
 Stevenson, L., 288, 388.  
 Stevenson, T. M., 432.  
 Stewart, C. P., 280, 308.  
 Stewart, E. A., 97, 98, 486.  
 Stewart, G., 190, 640.  
 Stiles, C. W., 83.  
 Stoa, T. E., 33.  
 Stock, T. D., 231.  
 Stockard, C. R., 635.  
 Stockbridge, L., 414.  
 Stockdale, C. E., 867.  
 Stockholm, M., 612.  
 Stockman, S., 380, 882.  
 Stoklasa, J., 122, 325.  
 Stone, A. L., 338.  
 Stone, R. E., 643, 648, 655.  
 Stone, R. W., 820.  
 Stone, W. S., 196.  
 Story, J. D., 390.  
 Stout, A. B., 238.  
 Stover, W. G., 548.  
 Strahan, J. L., 388.  
 Strahorn, A. T., 814.  
 Straight, E. M., 778.  
 Strampelli, N., 333, 437.  
 Strand, A. L., 599, 798.  
 Stratton, M. E., 24.  
 Strauss, M. B., 729.  
 Streeter, C. O., 98.  
 Strike, W. W., 716.  
 Stringfield, G. H., 699.  
 Strowd, W. H., 573.  
 Strutt, 208.  
 Stuart, W., 398.  
 Stuckey, H. P., 37.  
 Student, 827.  
 Stufflebeam, G. T., 593.  
 Sturtevant, A. H., 331, 731.  
 Suda, G., 564.  
 Sulvester, H. D., 497.  
 Summerby, R., 229, 549.  
 Summers, J. N., 657.  
 Sumner, F. B., 822, 823.  
 Sumner, J. B., 803.  
 Sunderlin, H. H., 100.  
 Sunila, J. E., 290.  
 Supplee, G. C., 876.  
 Sure, B., 710.  
 Sutton, G. L., 690.  
 Sutton, L. J., 511.  
 Swamidoss, D., 893.  
 Swann, H. K., 252.  
 Swanson, C. O., 20, 512.  
 Swartwout, H. G., 836.  
 Swartwout, J. D., 416.  
 Sweet, C., 739.  
 Sweet, S. S., 12.  
 Swenehart, J. H., 99, 799.  
 Swift, W. H., 194.  
 Swingle, D. B., 143.  
 Swingle, W. T., 743.  
 Switzer, J. A., 483.  
 Sydenstricker, E., 460.  
 Sze, T. P., 875.  
 Tabenzki, A. A., 235.  
 Taber, C. W., 797.  
 Tabor, P., 829.  
 Tacke, B., 511.  
 Taft, W. H., 195.  
 Taggart, J. G., 288.  
 Taggart, W. G., 33, 396.  
 Takahashi, K., 801.  
 Takezaki, Y., 330.  
 Talbert, T. J., 238.  
 Talbot, A. N., 385.  
 Talman, C. F., 313, 616.  
 Tamhane, V. A., 427.  
 Tammes, T., 25.  
 Tamura, O., 225.  
 Tannehill, I. R., 115.  
 Tanner, W. F., 284, 586, 669.  
 Tanret, G., 143.  
 Tansley, A. G., 626.  
 Tapley, W. T., 318, 699.  
 Tapp, J. W., 889.  
 Tassinari, G., 90.  
 Taubenhaus, J. J., 45, 136.  
 Taylor, A. E., 262.  
 Taylor, C. C., 390, 393, 893.  
 Taylor, E., 518.  
 Taylor, H. C., 198, 595, 896.  
 Taylor, H. F., 709.  
 Taylor, J. C., 699.  
 Taylor, J. W., 738.  
 Taylor, T. U., 286.  
 Taylor, W. A., 608.



- Taylor, W. K., 879.  
 Tedin, H., 735.  
 te Hennepe, B. J. C., 82.  
 Tempany, H. A., 820.  
 Templeton, G. S., 128.  
 Templeton, J., 428.  
 Tenhet, J. N., 56.  
 Teodorescu, I., 596.  
 Teodoro, N. G., 748.  
 Terao, H., 330.  
 Termer, F., 615.  
 Terroine, E. P., 125, 428.  
 Terry, J. R., 779.  
 Thadani, K. I., 633.  
 Thaden, J. F., 892.  
 Thatcher, R. W., 532, 597.  
 Thayer, P., 238.  
 Thelen, R., 243.  
 Theobald, F. V., 255.  
 Thiessen, A., 612.  
 Thoday, D., 427.  
 Thomas, E. M., 310.  
 Thomas, F. L., 758.  
 Thomas, G. I., 898.  
 Thomas, H. E., 549.  
 Thompson, E. H., 198.  
 Thompson, H. C., 300, 740.  
 Thompson, J. B., 510, 533, 540, 598.  
 Thompson, M. J., 120.  
 Thompson, N. F., 649.  
 Thompson, T. J., 274.  
 Thompson, W. C., 90.  
 Thompson, W. O., 895.  
 Thompson, W. R., 848.  
 Thompson, W. S., 492.  
 Thomsen, F. L., 593.  
 Thomson, 825.  
 Thomson, A. L., 786.  
 Thomson, G. M., 526.  
 Thomson, J. A., 355.  
 Thomson, J. J., 608.  
 Thon, J., 792.  
 Thone, F. E. A., 645.  
 Thorburn, A., 355\*  
 Thornber, H., 135, 139.  
 Thorne, J. R., 593.  
 Thornton, H. G., 816.  
 Thorp, W. P., jr., 873.  
 Thorpe, C., 543.  
 Thurston, F. M., 896.  
 Thurston, H. W., 446.  
 Tidmore, J. W., 203.  
 Tiedjens, V. A., 498.  
 Tiegs, O. W., 356.  
 Tietz, L., 590.  
 Tigerstedt, A. F., 838.  
 Tigerstedt, R., 700.  
 Tilford, P. E., 699.  
 Tillmans, J., 852.  
 Tinline, M. J., 272, 368, 369, 371, 372.  
 Tisdale, E. K., 148.  
 Tisdale, W. B., 44, 650.  
 Tisdall, F. F., 112.  
 Tisserand, 304.  
 Tolaas, A. G., 398.  
 Tomhave, A. E., 697.  
 Tomhave, W. H., 170, 869.  
 Tompson, H. F., 498.  
 Toole, E. H., 434, 740.  
 Toole, W., 467, 575, 777.  
 Toro, R. A., 748.  
 Torp, F. B., 94.  
 Torre-Bueno, J. R. de la, 755.  
 Tothill, J. D., 844.  
 Tottingham, W. E., 20, 628.  
 Toumey, J. W., 443.  
 Tower, W. V., 196, 552.  
 Townsend, C. A. H., 480.  
 Towt, L. V., 875.  
 Trabut, L., 822.  
 Tracy, P. H., 10, 782.  
 Trafton, G. H., 694.  
 Trappmann, W., 260.  
 Traum, J., 81.  
 Trautwein, K., 683.  
 Travers, W. C., 450.  
 Traverso, G. B., 439.  
 Tressler, D. K., 709.  
 Tretsvan, J. O., 590.  
 Trewartha, G. T., 797.  
 Tribolet, I., 645.  
 Tronchon, A., 588.  
 Trostel, L. J., 688.  
 Trouvelot, B., 558.  
 Trowbridge, E. A., 467.  
 Trowbridge, P. F., 868.  
 Truche, C., 586.  
 Truche, G., 82.  
 True, A. C., 3, 895, 896.  
 Trullinger, R. W., 100.  
 Truog, E., 524.  
 Tryon, H., 454.  
 Trzebiński, J., 348, 349, 353.  
 Tscherkes, L., 565.  
 Tachermak, E., 28.  
 Tucker, C. L., 286.  
 Tucker, C. M., 547.  
 Tuff, P., 185.  
 Tulaikov, N. M., 211, 321, 600.  
 Tullgren, A., 153.  
 Tungeln, G. H., Von, 892.  
 Tunis, T., 242.  
 Tunncliffe, H. E., 308.  
 Turk, E. E. De, 418.  
 Turley, T. B., 521.  
 Turnbow, G. D., 782.  
 Turner, C., 794.  
 Turner, C. W., 177, 278, 474, 578, 781, 874.  
 Turner, V. B., 392.  
 Turner, W. F., 556.  
 Turpin, E., 694.  
 Turrentine, J. W., 323.  
 Tutin, F., 310.  
 Tweed, R. L., 459.  
 Tyler, A. G., 486.  
 Tyndall, E. P. T., 714.  
 Uda, H., 531.  
 Uhlenhuth, 883.  
 Underhill, G. W., 759.  
 Uphof, I. C. T., 255.  
 Upshall, W. H., 643.  
 Upson, A. T., 187.  
 Upton, G. B., 187.  
 Urbain, A., 78, 79, 584.  
 Urban, J., 738.  
 Ure, R., 137.  
 Urich, F. W., 159.  
 Urodshevich, V., 882.  
 Urquhart, A. R., 234.  
 Utermark, W. L., 39.  
 Utkin, M. S., 350.  
 Uvarov, B. P., 257.  
 Vagliano, M., 362, 670, 858.  
 Vaglio, G., 149.  
 Valesco y Mendivil, J. M. D. de., 832.  
 Valgren, V. N., 391.  
 Vallée, H., 684.  
 Vance, S. H., 877.  
 Vandecaveye, S. C., 196, 818.  
 van der Merwe, A. R., 369.  
 van der Merwe, C. P., 257.  
 Vander Vaeren, J., 594.  
 van der Walle, N., 685.  
 Van Dine, D. L., 159.  
 Van Duzee, E. P., 755.  
 Van Es, L., 79, 185.  
 van Hall, C. J. J., 548.  
 van Harreveld, J., 32.  
 van Hoek, P., 193.  
 Vanino, L., 724.  
 Van Oort, E. D., 355.  
 Van Saun, A. I., 876.  
 van Slogteren, E., 452.  
 Vardon, A. C., 281.  
 Vaughan, L. H., 740.  
 Vaughan, R. E., 146, 652.  
 Vavilov, N. I., 29.  
 Veatch, J. O., 319, 419, 520, 617.  
 Velu, H., 81.  
 Venable, R., 285.  
 Vener, B., 878.  
 Vergé, G., 249, 644.  
 Verpoorten, M. G., 527.  
 Viado, B. O., 638.  
 Vickery, H. B., 8.  
 Vierheller, A. F., 300.  
 Vigliano, I. C., 345.  
 Villaraza, M. F., 434.  
 Villedieu, G., 245.  
 Villedieu, (Mrs.) G., 245.  
 Villegas, V., 267.  
 Vincent, G. E., 897.  
 Vinson, A. E., 417.  
 Vinter, 805.  
 Virville, A. D., de, 324.  
 Viswanath, B., 722.  
 Vitek, E., 238.  
 Vivian, A., 895.  
 Voelcker, J. A., 637, 819.  
 Vogel, J. C., 218.  
 Voglino, P., 149.  
 Vogt, P. L., 394, 893.

- Voicu, J., 120.  
 Voigt, A., 238.  
 Volkart, A., 237.  
 Vondruška, E., 594.  
 Vosbury, E. D., 38.  
 Voskuil, W. H., 321.  
 Votey, J. W., 896.  
 Voukassovitch, P., 561, 659.  
 Vries, O. de, 647.  
  
 Wache, R., 618.  
 Wade, E. B. H., 685.  
 Wade, J. S., 554, 849.  
 Waggaman, W. H., 424, 521, 723, 817, 818.  
 Wagner, E., 785.  
 Wagner, H., 724.  
 Wagner, P., 433.  
 Wahlen, F., 333.  
 Wahlgren, E., 153.  
 Wakeham, G., 460.  
 Wakeman, A. J., 710.  
 Waksman, S. A., 118, 517, 620.  
 Walden, B. H., 50, 848.  
 Waldmann, O., 683, 881.  
 Waldron, L. R., 33, 337.  
 Wales, R. L., 896.  
 Walker, C. L., 487.  
 Walker, F., 611.  
 Walker, G. T., 510.  
 Walker, H. B., 97, 100.  
 Walker, J. C., 650.  
 Walker, M. N., 651.  
 Walkey, F. L., 181.  
 Wallace, B. A., 393.  
 Wallace, H. A., 234, 435, 694.  
 Wallace, H. C., 197, 389, 895.  
 Wallace, Q. W., 172.  
 Wallace, R., 670.  
 Wallace, S. T. D., 433.  
 Walle, N. van der, 685.  
 Waller, A. G., 90.  
 Waller, O. L., 483.  
 Walmsley, F. D., 877.  
 Wälstedt, I., 136.  
 Walton, G. P., 501.  
 Walton, R. C., 445.  
 Walton, W. R., 435.  
 Warbasse, J. P., 92.  
 Warburton, C. W., 532.  
 Ward, F. E., 95, 893.  
 Ward, R. DeC., 315.  
 Wardall, R. A., 797.  
 Wardle, R. A., 253.  
 Ware, C. B., 893.  
 Ware, F., 783.  
 Ware, W. M., 439.  
 Waring, C. H., 669.  
 Warrington, K., 740.  
 Warren, D. C., 458.  
 Warren, G. F., 198.  
 Washburn, F. L., 153.  
 Waterhouse, W. L., 833.  
 Waterman, H. C., 360.  
  
 Waters, H. B., 828.  
 Waters, R., 449.  
 Waterston, J., 159.  
 Watson, C. C., 286.  
 Watson, E. A., 480.  
 Watson, G. W., 189.  
 Watson, J. A. S., 670.  
 Watson, J. R., 652, 659, 660.  
 Watson, R., 743.  
 Watts, F., 28, 433, 499, 600.  
 Watts, R. L., 496.  
 Waugh, F. V., 198.  
 Wearne, W. E., 545.  
 Weaver, L., 237.  
 Webb, H. F., 631.  
 Webb, J. L., 660.  
 Webb, R. W., 650, 839.  
 Webber, H. J., 497.  
 Weber, A., 148.  
 Weber, F., 525.  
 Weber, G. F., 648, 654, 747.  
 Webster, L. T., 478, 784.  
 Weeks, D., 99.  
 Weidman, F. D., 885.  
 Weidman, R. H., 807, 808.  
 Weigel, C. A., 55, 845.  
 Weimer, J. L., 21, 648, 655, 749.  
 Weiss, F., 649, 653.  
 Weiss, H. B., 257, 594.  
 Weiss, J. M., 58.  
 Welch, J. H., 182, 885.  
 Welch, M. B., 344.  
 Weller, H. O., 88.  
 Welles, C. G., 748.  
 Wellman, M. T., 298.  
 Wells, C. H., 715.  
 Wells, E. L., 416.  
 Wells, H. M., 300.  
 Wells, H. S., 282.  
 Werner, H. O., 335.  
 West, A. P., 308, 309.  
 West, C., 449.  
 West, J. H., 416.  
 West, R. M., 135.  
 Wester, D. H., 514.  
 Westermann, T., 117.  
 Wetmore, A., 754.  
 Wheeler, W. M., 253.  
 Whelpton, P. K., 699.  
 Wherry, E. T., 717.  
 Whetham, C. D., 280.  
 Whitaker, W. A., 33.  
 Whitcomb, W. D., 844.  
 Whitcomb, W. O., 740.  
 Whitcombe, D. D., 593.  
 White, A., 769.  
 White, A. D., 605.  
 White, C. T., 195.  
 White, D. G., 187.  
 White, E. P. C., 885.  
 White, G. C., 474.  
 White, G. F., 845, 846.  
 White, J. W., 422.  
 White, P., 189.  
 White, R. S., 156.  
 White, W. T., 787.  
  
 Whitehead, F. E., 697.  
 Whitehead, T., 349.  
 Whitehead, W. E., 844.  
 Whitehouse, W. E., 299.  
 Whiting, A. L., 800.  
 Whitney, M., 641.  
 Whittemore, H. L., 386.  
 Whittet, J. N., 434.  
 Whittier, E. O., 205.  
 Whittles, C. L., 515.  
 Wiancko, A. T., 733.  
 Wickersham, C. P., 844.  
 Widell, L., 296.  
 Widén, J., 238.  
 Widmark, E. M. P., 311, 615.  
 Wiegner, G., 865, 866.  
 Wieringa, G., 34.  
 Wiessmann, H., 425, 623.  
 Wiest, E., 590.  
 Wigand, 208.  
 Wiggans, R. G., 230, 435.  
 Wiggin, G. H., 49.  
 Wilcox, A. N., 130.  
 Wilcox, R. B., 699.  
 Wilcox, R. H., 199.  
 Wilder, R. M., 766.  
 Wiley, H. W., 196.  
 Wiley, J. B., 844.  
 Wiley, R. C., 213.  
 Wilkins, L., 669.  
 Will, H., 426.  
 Will, J., 555.  
 Willaman, J. J., 47, 48, 135, 146.  
 Willard, H. F., 54.  
 Willcox, G. B., 709.  
 Wille, J., 255.  
 Willett, W. R., 128.  
 Williams, A. M., 436.  
 Williams, C. B., 415.  
 Williams, C. F., 131.  
 Williams, C. L., 151.  
 Williams, C. O., 413.  
 Williams, D. W., 70.  
 Williams, F. G., 415.  
 Williams, G. W. M., 805.  
 Williams, I. W., 458.  
 Williams, J. O., 71.  
 Williams, J. R., 766.  
 Williams, K. V., 869.  
 Williams, L. F. R., 686.  
 Williams, L. R., 897.  
 Williams, O. E., 281, 782.  
 Williams, P. S., 474.  
 Williams, R. D., 34.  
 Williams, W. L., 783.  
 Williamson, M. M., 44, 348.  
 Willis, H. H., 435.  
 Willis, L. G., 320, 550.  
 Willson, C. A., 896.  
 Willson, D. A., 296.  
 Wilmner-Junius, E., 685.  
 Wilson, A. D., 532.  
 Wilson, C. E., 555, 598.  
 Wilson, C. P., 313.  
 Wilson, E., 113.  
 Wilson, E. B., 569.



- Wilson, H. E., 498.  
Wilson, H. F., 755.  
Wilson, I. D., 699.  
Wilson, J., 292, 580.  
Wilson, J. B., 501.  
Wilson, J. R., 772.  
Wimberger, H., 567.  
Winchcombe, Carson, Ltd., 369.  
Winchell, J. A., 496.  
Winchester, H. B., 65, 67.  
Windes, E., 596.  
Wing, DeW. C., 199.  
Wingard, S. A., 650.  
Winge, Ö., 226.  
Wingfield, J. C., 899.  
Winslow, C.-E. A., 64.  
Winslow, E. A., 762.  
Winston, J. R., 149, 239.  
Winter, A. R., 277.  
Winter, L. B., 765, 767.  
Winter, O. B., 714.  
Winters, N. E., 398.  
Wirt, F. A., 98.  
Wise, L. E., 206, 509.  
Witte, H., 28, 334, 735.  
Wittmack, L., 237.  
Witzemann, E. J., 767, 802.  
Wöber, A., 345.  
Woehlk, J. H., 716.  
Woglum, R. S., 657.  
Wolcott, G. N., 357, 457, 657.  
Wolf, F. A., 348, 746, 749.  
Wolfe, T. K., 633.  
Wolff, M., 555.  
Woll, F. W., 197.  
Wollman, E., 362.  
Wolman, A., 791.  
Wood, F. C., 180.  
Wood, I. A., 100.  
Wood, N. A., 452.  
Wood, W., 670.  
Woodbridge, M. E., 740.  
Woodman, H. E., 267, 268.  
Woodroof, J. G., 543.  
Woodward, C. R., 495.  
Woodward, T. E., 475.  
Woodworth, C. M., 632.  
Woodworth, H. C., 390.  
Woodyatt, R. T., 766.  
Woolard, E. W., 808.  
Wooley, J. C., 98, 187.  
Wooley, R. V. G., 239.  
Wooten, E. O., 190.  
Work, H., 895.  
Working, H., 193.  
Wormald, H., 245.  
Wormeley, P. L., 486.  
Worrall, L., 436.  
Worthington, R. E., 40.  
Wright, A., 612.  
Wright, F. W., 876.  
Wright, H. J., 545.  
Wright, L. H., 684.  
Wright, R., 39.  
Wright, R. P., 391.  
Wright, S., 527.  
Wright, T. H., jr., 75.  
Wright, W. G., 141.  
Wurmser, R., 125, 428.  
Wurth, T., 499.  
Wyant, Z. N., 459.  
Wylie, C. E., 178.  
Wyllie, J., 191.  
Wyon, G. A., 769.  
Wysor, W. G., 641.  
Yampolsky, C., 431.  
Yampolsky, H., 431.  
Yates, J. W., 877.  
Yeager, A. F., 837.  
Yeats, G. A. L., 252.  
Yerkes, G. E., 643.  
Yien, S. C., 235.  
Yoder, F. R., 391.  
Yoder, P. A., 525.  
Yonge, C. M., 500.  
York, H. H., 753.  
Yothers, M. A., 844.  
Yothers, W. W., 239.  
Young, F. D., 807, 808.  
Young, G. A., 188.  
Young, H. C., 345.  
Young, J. B., 522, 523, 625, 819.  
Young, W. De, 617.  
Young, W. J., 145.  
Youngman, W., 639.  
Yudkin, A. M., 463, 464.  
Zaepffel, E., 127, 225.  
Zalensky, W. R., 600.  
Zappe, M. P., 50.  
Zarfi, M., 567.  
Zavadovskii, M., 825.  
Zeller, G. A., 360.  
Zeller, H., 881.  
Zeller, S. M., 148, 750, 751.  
Zetek, J., 259.  
Zietzschmann, O., 76.  
Zikes, H., 428, 545.  
Zilva, S. S., 267, 665, 771.  
Zimmer, G. F., 627.  
Zimmerley, H. H., 843.  
Zimmerman, O. B., 98, 485.  
Zimmermann, A., 727.  
Zinsser, H., 478, 581.  
Zivy, R., 879.  
Zon, R., 141, 240, 898.  
Zook, G. F., 194.  
Zucker, T. F., 771, 772.  
Zuill, F., 796.  
Zundel, G. L., 144.  
Zunker, F., 84, 86.





## INDEX OF SUBJECTS.

NOTE.—The abbreviations "Ala.Col.," "Conn.State," "Mass.," etc., after entries refer to the publications of the respective State experiment stations; "Alaska," "Guam," "Hawaii," "P.R.," and "V.I." to those of the experiment stations in Alaska, Guam, Hawaii, Porto Rico, and Virgin Islands; "Can." to those of the experiment stations in Canada; and "U.S.D.A." to those of this Department.

- Abaca—  
 disease, 549.  
 fiber, deterioration, 434.  
 grading baling, and inspection, 434.  
 papers on, 638.  
 properties and uses, 534.  
 varieties, fiber yield, 829.
- Abortion—  
 and Malta fever, causative organisms, relation, 183.  
 artificial immunity, Minn., 181.  
 bacillus in milk of infected cows, 480.  
 diagnosis, West.Wash., 584.  
 diseases causing, 78.  
 effect on milk production, Ky. 874.  
 epizootic, in cattle, 582.  
 in farm livestock, summary, Nebr., 79.  
 prevention, summary, 480.  
 studies, Vt., 381.  
 tests for, 879.  
 (See also *Bacillus abortus* and *Bacterium abortus*.)
- Acarapis woodi* in Switzerland, 762.  
 Acarine disease in Switzerland, 762.  
 Accessory food factors. (See Vitamins.)  
 Accounting, farm. (See Farm accounting.)  
 Acetic acid, toxic action for white mice, 569.  
 Acetone—  
 from fermentation of corn, 12.  
 solvent properties, 201.  
 Acetyl value, determination, 11.  
 Acid phosphate. (See Superphosphate.)  
 Acid produced by *Sterigmatocystis nigra*, 328.  
 Acidity—  
 in muck soils, N.C., 320.  
 ion exchange, in mineral soils, 514.  
 of ice cream, effect, 281.
- Acids—  
 amino. (See Amino acids.)  
 fatty. (See Fatty acids.)  
 in storage apples, 542.  
 produced by *Rhizopus tritici* on sweet potato, 21.  
 toxicity for mosquito larvae, 357.  
 volatile, produced by starters, Iowa, 109.
- Acrostalagmus caulophagus*, notes, 354.  
*Actinomyces chromogenus*, notes, 550.  
 Adlay, milling tests, 829.
- Adrenalin equilibrium, effects of vitamin deficiency, 668.  
 Adrenals, sheep's, antirachitic properties, 771.  
 Adsorption in soils, 16.  
 Adsorption of plant nutrients, 16.  
*Aedes* spp., behavior, relation to atmospheric conditions, 757.  
*Aeginetia indica*, life history and control, 248.  
 Aerological investigations, kites and balloons for, U.S.D.A., 314.  
 Afforestation. (See Forestation.)  
*Agamofilaria tabanicola*, notes, 359.  
 Agaves, fiber elements, 434.  
 Agaves, varieties, 29.  
 Agglutination test for abortion, West. Wash., 584.  
 Aggregates, road. (See Road materials.)  
 Agrarian reform in Czechoslovakia, 91, 594.  
 Agrarian reform in Esthonia, 393.  
 Agricultural—  
 associations in Switzerland, statutes of, 393.  
 chemistry. (See Chemistry.)  
 college, curriculum, 495.  
 college instruction, papers on, 895.  
 colleges in Great Britain, new buildings for, 800.  
 (See also Alabama, Arizona, etc.)  
 cooperation—  
 in Argentina, 92.  
 in Denmark, 296.  
 in India, 192, 795, 894.  
 in Italy, 93.  
 in Prague, 894.  
 in southern highlands, 296.  
 reading list, U.S.D.A., 92.  
 Council of Denmark, activities, 533.  
 credit—  
 in Italy, 593.  
 in North Carolina, 391.  
 in United States, 291.  
 in Utah, Utah, 291.  
 intermediate, U.S.D.A., 291.  
 legislation, 690.  
 mortgage system, 91.  
 of United States, 490.  
 system, creating, 91.  
 Credits Act in England, 793.  
 Credits Act of 1923, 391, 793.

## Agricultural—Continued.

- crisis, causes, 489.
- digest, King's, 1923, 93.
- economics. (*See* Rural economics.)
- education—
  - curriculum construction, 897.
  - in Brazil, 399.
  - in Ireland, 694.
  - in Norway, 93.
  - in Ontario, 596.
  - report, 93.
  - treatise, 897.
- education, vocational—
  - deriving courses of study in, 394.
  - evening school work in, 297.
  - in Texas, 297.
  - relation to nonvocational education, 297.
  - score card method of rating, 694.
  - teaching, job analysis in, 693.
  - tendencies, 94.
- education. (*See also* Agricultural colleges, Agricultural instruction, Agricultural schools, *etc.*)
- engineering. (*See* Engineering.)
- estates, taxation, 192.
- experiment stations. (*See* Experiment stations.)
- extension—
  - in Spain, 599.
  - papers on, 896.
  - teaching, State policy in, 897.
- forecasts, paper on, 198, 595.
- Holdings Act, provisions, 792.
- improvement, papers on, 896.
- industry in Queensland, organization, 390.
- inquiry in Congress, 488.
- Institute in Shantung, 499.
- instruction—
  - handling laboratory work in, 597.
  - in Ireland, 394.
  - job lesson units, 898.
  - (*See also* Agricultural education.)
- journals, new, 499, 500.
- labor—
  - conditions in Europe, 291.
  - in Finland, 892.
  - in France, 392.
  - in France, treatise, 292.
  - in Scandinavia, 392.
  - Scottish, 292.
  - wages, 793.
- legislation, international yearbook, 393.
- machinery and its operation, treatise, 588.
- machinery in Germany, 388.
- machinery, tests, 687.
- machinery, treatise, 189.
- organization in United States, treatise, 590.
- organizations, relation to agricultural colleges, 896.
- problems in Hungary, 193.

## Agricultural—Continued.

- production—
  - and native products from Africa, 596.
  - cooperation in, 92.
  - in Algeria, 793.
- products—
  - cost of production, Can., 591, 592. (*See also specific crops.*)
  - exports to Cuba, 693.
  - exports to Europe, 596.
  - Franco-Polish commerce in, 794.
  - marketing. (*See* Marketing.)
  - prices, Minn., 193; Ohio, 294, 594.
  - prices, factors affecting, Nebr., 594.
  - prices, relation to manufactures, 691.
  - warehousing, U.S.D.A., 293.
- research—
  - administration, 896.
  - in America, 93.
  - in Great Britain, Canada, and France since the war, 301.
  - stage of diminishing returns, 401.
  - workers, facilities offered by Rothamsted to, 400.
- resources in Canada, 793.
- schools, evening, 495.
- short courses for farmers, West. Wash., 195.
- situation in Czechoslovakia, U.S.D.A., 296.
- situation in Hungary, U.S.D.A., 296.
- statistics, 194, 296.
- statistics—
  - international yearbook, 393.
  - of Belgium, 594, 895.
  - of Brazil, 596, 894.
  - of Bulgaria, 795.
  - of Chile, 393, 895.
  - of Danube Basin, 296.
  - of Esthonia, 895.
  - of France 394.
  - of Iceland, 795.
  - of India, 693.
  - of Ireland, 793.
  - of Italy, 693.
  - of Michigan, 93.
  - of Norway, 795.
  - of Rumania, 596.
  - of Sweden, 296, 693.
  - of the South, 894.
  - of Union of South Africa, 93.
  - of United States, 795.
  - of Wisconsin, 894.
- survey of Europe, U.S.D.A., 296.
- teachers, training, 795, 896, 897.
- tenancy. (*See* Land holdings, Land tenancy, and Land tenure.)
- terminology, definitions, 200.
- Agriculture—
  - American, economic history, treatise, 691, 792.
  - and dairying, 891.



## Agriculture—Continued.

- and transportation, 490.
- business of, course in, 198.
- chair of, at University of Liverpool, 400.
- course of study, 395.
- course of study in Vermont, 496.
- effect of business, 198.
- electricity in, 388.
- elementary, course in, 496, 796.
- existing systems in Europe, 291.
- financing, 593.
- for high schools in North Dakota, syllabus, 796.
- for high schools, textbook, 94.
- for Kansas common schools, textbook, 298.
- high school students of, data regarding, 394.
- in Algeria, 193.
- in Armenia, 193.
- in Denmark, 296.
- in Denmark and world depression, 794.
- in Finland, 290, 892.
- in France, winter schools, 597.
- in Germany, foreign labor in, 890.
- in Great Britain, contribution of land-owners, 792.
- in Ireland, 793, 892.
- in Netherlands, 193.
- in New Zealand, 693.
- in northwestern grain raising areas, 192.
- in southern Indiana, 390.
- of New Jersey, graphic summary, 594.
- postgraduate courses in, at Pusa, 297.
- recovery of, 89.
- rotation of chemical elements in, Mich., 411.
- self-supporting, emergency commission for, 891.
- standards of production, 290.
- statistical method in, 298.
- study in elementary school, 596.
- substances important in, treatise, 311.
- teaching, 693.
- tropical, guide, 637.
- use of explosives in, N.J., 791.
- Agrilus anxius*, notes., Conn.-State, 50.
- Agrisol treatment of moldy rot disease, 49, 250.
- Agrotis segetum*, enemies and diseases, 255.
- Air, irradiated by ultra-violet light, effect on growth in rats, 265.
- Aircraft, protection from insects, 555.
- Aitken, J., scientific papers of, 414.
- Alabama argillacea*, control, 658.
- Alabama—
  - College, notes, 396, 899.
  - Station, notes, 396.
  - Station, report, 696.
- Alaska—
  - Stations, notes, 899.
  - Stations, report, 597.
- Albumin of wheat bran, analyses, 711.

## Alcohol—

- as engine fuel, 588.
- power, from calcium carbid, 287.
- (See also Methyl alcohol.)
- Alcoholic fermentation, treatise, 806.
- Alder, white, relation to soil improvement, 838.
- Aldoses—
  - in presence of other carbohydrates, determination, 614.
  - iodometric determination, 613.
- Aleochara algarum*, life history and habits, 850.
- Aleomyia, new genus, erection, 457.
- Aleurodicus manni* n.sp., description, 155.
- Aleurone grains, formation, 222.
- Aleyrodidae of Brazil, catalogue, 556.
- Aleyrodidae of Jamaica, 556.
- Alfalfa—
  - analyses, Oreg., 7.
  - and silage, feeding value, Ohio, 170.
  - as affected by sodium chlorid, 625.
  - breeding experiments, Can., 433.
  - cotton root rot fungus affecting, 747.
  - culture, Mont., 535; N.Mex., 29.
  - culture experiments, Alaska, 532; Conn.Storrs, 334; Mont., 134.
  - culture in Argentina, 29.
  - diseases in California, 447.
  - eelworm disease, description, U.S.D.A., 145.
  - ensiling, Italian method, 468.
  - feeding value, Oreg., 66.
  - fertilizer experiments, Conn.Storrs, 334; Minn., 121; N.Mex., 232.
  - green, effect on flavor of milk, U.S. D.A., 376.
  - hay, effect on milk production, W.Va., 73.
  - in California, stem nematode, 447.
  - irrigation experiments, 829.
  - leaves, temperature, 425.
  - methods of feeding, Kans., 67.
  - plant, basic substances from, 710.
  - rotation experiments, N.Y.State, 422.
  - seed from Argentina, identification, 740.
  - seed production, U.S.D.A., 132.
  - seeding experiments, Can., 533; Conn. Storrs, 334.
  - silage. (See Silage.)
  - v. Sudan grass, feeding value, Kans., 68.
  - variety tests, Mont., 134; U.S.D.A., 132.
  - water requirements, 734, 828.
  - weevil, chalcidoid parasite of, 260.
  - weevil, notes, 151.
  - winter habit, 333.
  - yield and composition, factors affecting, 726.
- Algeria, economic guide for, treatise, 93.
- Alkali—
  - lakes of west Texas, 724.
  - reserve of blood in avitaminosis, 862.
  - salts. (See Sodium salts.)

## Alkali—Continued.

- soils, ammonia determination in, 203.
- soils, improvement with sulphur, 726.
- soils in humid portions of Finland, 15.
- soils, reclamation, Calif., 214.
- soils, reclamation, treatise, 321.

## Alkaline—

- earths, effect on lupines, 426.
- soil reaction, effect on plants, 814.

## Alkaloid behavior in development of belladonna in darkness, 223.

## Alkaloids—

- analytical chemistry of, 201.
- formation in leaves, effect of sunlight, 223.

## Almond oil, vitamin A in, 857.

## Almond proteins, biological value, 857.

## Almonds—

- calcium in, utilization by man, 764.
- digestibility, 764.

*Alternaria*—

- spp., utilization of citric acid by, 630.
- tenuis*, notes, 248.

## Alum soils in humid portions of Finland, 15.

## Aluminum—

- active, and H-ion concentrations in acid soil, 220.
- active, toxic properties, R.I., 16.
- sulphate, use, 844.

*Alysia manducator*, notes, 360.

## American—

- Farm Economic Association, proceedings, 197.
- National Livestock Association, proceedings, 268.
- Society for Horticultural Science, proceedings, 299.
- Society of Agricultural Engineers, proceedings, 96.

## Amino acids—

- and bacterial growth, 769.
- effect on enzymic hydrolysis of starch, 611.
- electrometric titration, 615.
- titration applied to, 802.

## Ammonia—

- absorption from solutions of ammonium salts, 722.
- determination in alkali soils, 203.
- from atmospheric nitrogen, 722.
- oxidation, mechanism, 320.
- volatilization from ammonium sulphate, 722.

## Ammonification—

- as affected by potassium fertilizers, 818.
- effect of temperature, 516.
- of arid soils, 420.

## Ammonium—

- chlorid, fertilizing value, U.S.D.A., 621.
- hydroxid, effect on insulin, 802.
- nitrate, fertilizing value, U.S.D.A., 621.

## Ammonium—Continued.

- phosphate, fertilizing value, U.S.D.A., 621.

- sulphate, fertilizing value, 423, 424.

- sulphate nitrate, fertilizing value, 423.

- sulphate production in 1922, 122.

- superphosphate and Rhenania nitrogen phosphate, comparison, 817.

## Ammono-phos, effect on seed germination and plant growth, N.J., 215.

*Amphicoma vulpina*, control, Mass., 659.*Amphorophora sensoriata*, description, 454.

## Amylase, pancreatic, effect of amino acids on decomposition, 611.

*Anabrus simplex*, notes, 151.

## Anaerobes—

- effect of plant tissue on, 879.
- metabolism, 785.
- pathogenic, review of literature, 478.
- toxin-producing, in Wisconsin, 682.

## Anaerobiosis, 627.

*Ancylis comptana*. (See Strawberry leaf roller.)*Andropogon intermedius*, analyses, 168.

## Anemia—

- infectious, iron content of blood 684.
- progressive pernicious, of bovines, 481.
- studies, 262.

*Angitia fenestralis*, biology, 561.

## Animal—

- breeding, methods, 367.
- breeding, progress in, 467.
- (See also Breeding and specific animals.)

## chromosomes. (See Chromosomes.)

## Diseases Act in Canada, 582.

## diseases—

- clinical diagnosis, textbook, 379.
- in Bombay, 479.
- in Burma, 77.
- in Canada, 582.
- in Denmark, 479.
- in India, 783.
- in New Zealand, treatise, 76.
- in Norway, 582.
- in Ontario, 878.
- in Oregon, 879.
- in Punjab, 480.
- infectious, in Germany, 182.
- infectious, prevention and control, Ohio, 582.
- obscure, Minn., 181.

## (See also specific diseases.)

## feeding, adipo-protein ratio, 267.

## feeding, principles, 266.

## growth as affected by light, 362.

## life in deserts, treatise, 355.

## nutrition, principles, 266.

## nutrition problems, 266.

## nutrition research at Rowett Institute, 266.

## nutrition, studies, Minn., 175; Mo., 868.

## parasites of domestic animals, Calif., 845.



## Animal—Continued.

- parasites, treatise, 554
- pests, control, Calif., 845.

## Animals—

- age in, equivalence, Mo., 467.
- captive wild, disease, treatise, 885.
- dairy, food requirements, Minn., 175.
- domestic—
  - cod liver oil for, 267.
  - endoparasites of, Minn., 152.
  - growth, Mo., 466.
  - intersexuality in, 130.
  - pathological anatomy, treatise, 379.
- relation to *Anopheles*, 559.
- experimental, photographing, 367.
- identification by nose prints, 269.
- intersexual, histological study, 227.
- laboratory, vitamin requirements, Minn., 163.
- management, 775.
- ruminants, metabolism experiments, 573.
- small, body temperature in different parts, correlation, Minn., 182.
- small domestic, diseases and treatment, 582.
- (See also Cattle, Livestock, Mammals, Sheep, etc.)

*Anomala orientalis* in Connecticut, Conn.-State, 50.

*Anopheles*—

- dispersal, 559.
- longevity, 255.
- Panama Canal Zone species, 259.
- relation to domestic animals, 559.
- winter activities in the South, 758.
- (See also Mosquitoes.)

*Anopheles maculipennis*, breeding in captivity, 559.

Ant invasions, control, Conn.State, 50.

Anthelmintics, chemical composition and therapeutic values, 380.

## Anthocyan—

- formation at expense of preexisting glucosids, 127.
- of grapes, analyses, N.Y.State, 410.
- physiological rôle, 22.
- (See also Pigments.)

## Anthocyanic pigments—

- formation, 224.
- in fruits, mitochondrial origin, 22.

## Anthocyanidins—

- distribution in colored plant organs, 326.
- free, in fruits, 127.
- free, in red flowers and leaves, 127.
- in plant tissues, pseudo bases of, 427.

*Anthonomus grandis*. (See Cotton boll weevil.)

*Anthonomus pomorum*, life history, 458, 560.

Anthracnose. (See specific host plants.)

## Anthrax—

- equine, immunization, 79.
- immunization in Algeria, 182.
- infection, portal of entry, 79.

## Anthrax—Continued.

- infection, variations, 881.
- notes, 582.
- occurrence in Great Britain, 182.
- paths of infection, 284.
- symptomatic. (See Blackleg.)
- vaccine, Australian, 881.

*Anthrenus* spp., control, U.S.D.A., 56.

*Anthromycopsis filiformis* n.sp., notes, 42.

Antibodies, acquired inheritance, 783.

Antihog-cholera serum and virus, distribution, Minn., 181.

Antineuritic vitamin. (See Vitamin.)

Antirachitic substances, distribution, 771.

Antirrhinum wilt, notes, 547.

Antiscorbutic. (See also Scurvy.)

Antiscorbutic vitamin. (See Vitamin C.)

Antistreptococcic dressing, studies, 78.

Antixerophthalmic vitamin. (See Vitamin A.)

## Ants—

- red, pupae as poultry feed, 576.
- studies, 260.
- white. (See Termites.)

*Aphaereta cephalotes*, notes, 360.

Aphididae of Minnesota, synoptical key, 755.

Aphidozer, effectiveness, 557.

## Aphids—

- cage for rearing on plants, 151.
- feeding punctures, effect on plants, Pa., 557.
- on fruit, 255.

## Aphis—

- adusta* as carrier of mosaic, 840.
- pomi*. (See Apple aphid.)
- pseudobrassicae*, notes, Conn.State, 51.

*Aphycus lounsburyi*, present status, 663.

Apiaries, inspection, Conn.State, 50.

Apiculture. (See Beekeeping.)

*Aplanobacter stewarti*, transmission of, 747.

Appalachian Forest Experiment Station, research projects, 240.

## Apparatus—

- for alpha-naphthol test for sucrose, 11.
- for catalytic hydrogenation of oils, 309.
- for determining dissolved oxygen, 201.
- for modulus of rupture tests, 809.
- for separating sand and clay, 14.
- for soil analysis, 809.
- for ultrafiltration, 612.
- Murneek, pressure, 441, 541.
- nephelometer, modifications, 312.
- used in highway research projects, 386.
- used in testing yarns and fabrics, 234.

## Apple—

- aphid eggs, washes for killing, 557.
- aphid, green, resistance of apple stocks to, 845.
- bitter pit, cause, 450.
- bitter pit, notes, 546.
- black rot, control, Pa., 445.
- blossom weevil, control, 560.

## Apple—Continued.

- blossom weevil, life history, 458, 560.
- blotch cankers, origin, 249, 750.
- blotch control, 249.
- blotch, time of infection, Pa., 445.
- brown heart, cause, 449.
- canker, European, in Oregon, 148.
- canker, European, in Pacific States, 750.
- crosses, Oldenburg as ovule parent, 834.
- deep scald, notes, 450.
- die-back, cause, 449.
- diseases, nonparasitic, 449.
- industry in Mount Etna region, 342.
- insects, control, N.Y. State, 555.
- leaf roller, control, 257.
- maggot, control, Minn., 152.
- orchards, management, Mass., 642.
- orchards, planting and care, 541.
- pomace, dried, digestibility, Mass., 168.
- rootstocks, susceptibility to black root rot, 750.
- scab, control, 353, 552; Mass., 655; Pa., 446.
- scab control in Wisconsin, 750.
- scald, control, 750, 841; U.S.D.A., 552.
- scald, development, 541.
- shoots, response to ringing and defoliation, 299.
- shoots, summer growth, Oreg., 741.
- tissue, darkening, Calif., 409.
- tree rosette, cause, 449.
- trees, age at time of planting, N.Y. State, 539.
- trees, one-year, varietal differences, 341.
- trees, size differences, cause and permanence, Me., 37.
- trees, young, pruning, Ind., 341.

## Apples—

- bearing habit, 340.
- boxed, marketing, 393.
- breeding, Minn., 140.
- breeding experiments, 37.
- copper injury, 449.
- culture experiments in Arizona, U.S. D.A., 138.
- effect of stock on scion, 140.
- fertilizer experiments, Pa., 440.
- growth, relation to cover sprays, 844.
- hardiness, testing by freezing points, Minn., 125.
- insects affecting in France, 256.
- irrigation studies, Can., 340.
- keeping quality, relation to time of picking, Can., 340.
- nitrogen and carbohydrate in developing fruit, 835.
- propagation, 300.
- resistance to green apple aphid, 845.
- ripening, changes in respiration rate, 441, 542.
- self-compatibility tests, Can., 339.
- shipped, flesh collapse of, 449.
- spraying and dusting, 353.
- spraying v. dusting, Can., 440.

## Apples—Continued.

- storage studies, 238, 541, 542.
- stored, oxidase activity in, 299.
- thinning tests, Can., 340, 643.
- time for applying first spray, 346.
- variety tests, Can., 36, 440.
- waxlike coating, constituents, 7.
- wilting, notes, 541.
- yield and keeping quality, Can., 340.

## Apricot—

- gall disease, description, 450.
- trees, starch storage in, 835.

## Apricots—

- culture experiments in Arizona, U.S. D.A., 138.
- starch stored in, 299.
- thinning tests, Can., 340.

Arghan fiber, commercial status, 829.

Arkansas Station, notes, 196.

*Armadillidium* spp., notes, 255.

Army worm, fall, notes, V.I., 555.

## Arsenic—

- a catalytic fertilizer, 324.
- acid as substitute for vitamins, 564.
- available supply in United States, 554.
- determination in gelatin, 712.
- inhalation from arsenical dusts, 453.
- relation to boll weevil control, 851.
- solution for poisoning green timber, Mich. 445.
- water-soluble, determination, 196.
- water-soluble, of lead arsenates, expression, 205.

## Arsenical injury—

- studies, Mont., 143.
- to plant and excretions from leaves, 525.

Arsenicals. (*See also* Calcium arsenate and Lead arsenate.)

## Artichokes—

- feeding value, 376.
- globe, changes in vitamins, 462.

Arum soft rot, notes, 547.

Ascaricides, notes, 380.

*Ascaridia perspicillum* control, 82.

Ascaridol, anthelmintic value, 380.

## Ash—

- determination in gelatin, 712.
- soils, fertilizer requirements, 817.
- tree, aleurodid enemy of, 556.
- trees, *Leperisinus californicus* affecting, 259.

## Asparagus—

- new disease of, 747.
- varieties, Mont., 139.

Aspergillosis in chickens, epizootic, 788.

## Aspergillus—

- fumigatus*, notes, 788.
- niger*, glucose utilization by, 125.
- niger* growth, energy ratio, 428.
- niger*, penetration into hardwood, 656.
- oryzae*, formation of perithecia by, 545.
- oryzae* spores, longevity, 630.
- repens*, sugar inverting power, 728.
- sp. on figs, 751.
- sp., utilization of citric acid by, 630.
- spp. in soil, activities, 620.

Asphodel as food for animals, 168.



- Aspidiotus perniciosus*. (See San José scale.)
- Association of—
- Land-Grant Colleges, proceedings, 895.
  - Official Agricultural Chemists, proceedings, 196.
  - Official Seed Analysts, proceedings, 739.
  - Southern Agricultural Workers, 398.
- Atmometers, blackened spheres for, 328.
- Atmospheric moisture. (See Humidity.)
- Attagenus piceus*, control, U.S.D.A., 56.
- Automobile tires, dynamometer tests, 486.
- Automotive power, encyclopedia, 486.
- Avitaminosis—
- alkali reserve of blood in, 862.
  - blood of pigeons in, 860.
  - B in pigeons, changes in weight of organs, 62.
  - B in pigeons, studies, 62.
  - carbohydrate metabolism in, 163.
  - cephalin and lecithin of brain in, 862.
  - course, in partial starvation, 565.
  - fat content of blood in, 860.
  - fat metabolism in, 860.
  - glycogen formation and exchange in, 863.
  - in guinea pigs, changes in weight of organs, 465.
  - phosphorus metabolism in, 862.
  - (See also Vitamin deficiency.)
- Avocado fungus disease, notes, 354.
- Avocados—
- Conotrachelus affecting, 458.
  - cross-pollination, 238.
  - culture, Calif., 342.
  - embryo budding, 644.
  - grafting, 543.
- Azofication, effect of nitrogen in soil, Utah, 119.
- Babcock test, modification, 11.
- Bacillus*—
- abortus* discharge, detection in milk, 682.
  - abortus*, germ-free filtrates, behavior, 681.
  - (See also *Bacterium abortus* and Abortion.)
  - acidophilus*, effect on chicks, 884.
  - acidophilus* milk, therapeutic value, 161.
  - adherens*, growth-promoting substances of, 664.
  - aerofetidis*, effect of plant tissue on, 879.
  - amylovorus*, notes, Ga., 543.
  - anthracis*, studies, 79.
  - aroideae*, notes, 547.
  - bipolaris septicus*, notes, 683.
  - botulinus*—
    - growth and biochemical activities, 785.
    - identification, 64.
    - in soils and vegetables from same, 365.
- Bacillus*—Continued.
- botulinus* continued.
    - toxicity, effect of acidification, 569.
    - type C, chemical activity, 785.
    - (See also *Clostridium botulinum*.)
  - cellulosae dissolvens*, notes, 763.
  - chauvanei*, effect of plant tissue on, 879.
  - coli* in ground water, movement, 83.
  - edematis*, effect of plant tissue on, 879.
  - gallinarum*, notes, 185.
  - histolyticus*, effect of plant tissue on, 879.
  - influenzae*, nutrition, 786.
  - jeffersoni*, notes, 185.
  - lathyri*, notes, 547.
  - mucosus capsulatus*, growth-promoting substances of, 664.
  - noctuarum* n.sp., notes, 846.
  - oleraceae*, notes, 353.
  - parabotulinus*, specific identity, 584.
  - paratyphosus* B, enzootic due to, 586.
  - pfafl*, notes, 185.
  - pullorum*, notes, 82.
  - pyogenes*, notes, 881.
  - rettgeri*, notes, 185.
  - sanguinarium*, notes, 82, 185.
  - solanacearum*, notes, U.S.D.A., 47.
  - (See also *Bacterium solanacearum*.)
  - sphingidis* n.sp., notes, 845.
  - sporogenes*, growth and biochemical activities, 785.
  - suberis*, provisional name, 788.
  - tetani*, growth and biochemical activities, 785.
  - timothy* 213, growth-promoting substances of, 664.
  - typhosus*, immunity inheritance, 783.
- Bacon hog raising, principles, 575.
- Bacon, soft oily, cause and prevention, 172.
- Bacteria—
- anaerobic. (See Anaerobes.)
  - and vitamins, 769.
  - gelatin liquefaction by, 526.
  - growth-promoting properties, 664.
  - hemoglobinophilic, occurrence and classification, 478.
  - in milk, soil, etc. (See Milk, Soils, etc.)
  - life cycles, 728.
  - morphology and biology, 526.
  - nitrifying, relation to reactions and concentrations of media, 516.
  - nutrition, 786.
  - removal from drinking water by chlorine gas, 590.
  - sulphur-oxidizing, growth and respiration, 517.
- Bacterial—
- infection, relation to polyn neuritis, 770.
  - suspensions, determining number, 680.
- Bacteriologic culture media. (See Culture media.)

## Bacteriology—

- agricultural, treatise, 526.
- and serology, technique and methods, treatise, 180.
- textbook, 478.

*Bacterium*—

- abortus*, rapid method of cultivation, Minn., 181.

(See also *Bacillus abortus* and Abortion.)

- acidi propionici* (d), action, 279.
- acidi propionici* (d), notes, 109, 205.
- apii*, control, 651.
- citriputeale*, relation to weather, 752.
- delendae-muscae* n. sp., description, 455.
- ichthyosmius*, effect on keeping quality of butter, 476.
- ichthyosmius*, notes, Wis., 280.
- panici* n. sp., description, 550.
- pneumosintes*, effect of plant tissue on, 879.
- pullorum* infection, effect on hatchability of eggs, 685.
- pullorum*, notes, 185.
- solanacearum*, additional hosts for, 746.
- solanacearum*, notes, 347, 550.
- (See also *Bacillus solanacearum*.)
- tabacum*, effect of temperature, 41.
- tabacum*, notes, 749.
- trifoliorum* n. sp., description, 349.
- tumefaciens*, studies, 42, 745.
- vascularum*, notes, 351.
- viridifaciens* n. sp., description, 45.

## Baking powders, working action, 852.

## Balsam, culture and preparation of products, 140.

## Bamboo, vascular anatomy, 728.

## Banana—

- freckle in Philippines, 752.
- root-borer, summary, 661.
- wilt on manila hemp, 549.

## Barberry eradication—

- campaign, progress, 649.
- in Wisconsin, Wis., 649.

*Baris* spp. on cabbage, 851.

## Bark beetles—

- new, from Colorado, 453.
- review of literature, 255.

## Barley—

- breeding experiments, 28; Minn., 132.
- breeding in Sweden, 735.
- certification in Germany, 439.
- cost of production, Can., 592.
- covered smut, control, 347.
- culture experiments, 637; Alaska, 532; Can., 231.
- detection in feeds, 468.
- effect of soil and season, 233.
- electroculture experiments, 131.
- feeding value, Can., 370.
- fertilizer experiments, 233, 637; Can., 817; Minn., 120.
- for Volga region, composition, 169.

## Barley—Continued.

- hybrids, 24.
- hybrids, inheritance of physiological characters, 228.
- inheritance of leaf color, 330.
- leaf stripe, studies, 245.
- methods of feeding, Mont., 171.
- net energy value in feeds, 572.
- rate of manuring tests, Minn., 121.
- screenings, digestibility, Mass., 168.
- seed weight, relation to resulting crop, 636.
- seeding experiments, Minn., 132.
- seedling blight, cause, 648.
- smooth awned, origin, 29.
- smut, control, 245.
- sources of potash for, 818.
- starch determination in, 312.
- v. peas for pigs, Can., 776.
- varieties, characteristics, 237.
- varieties for seed in Poland, 439.
- variety tests, Can. 432, 533; Minn., 133; Mont., 133; U.S.D.A., 132; West.Wash., 134.
- water requirements, 828.

## Barns, reconstruction, 388.

*Baryodma ontarionis*, notes, Pa., 454.

## Basic slag. (See Phosphatic slag.)

## Bat guano, fertilizing value, 322.

## Batteries, storage, efficiency, 486.

## Bayer 205—

- for dourine treatment 81.
- for *Trypanosoma* spp., 184, 584.

## Bean—

- anthracnose, biologic forms, Minn., 143.
- bacterial disease on Limas, 44; Pa., 445.
- beetle, Mexican, distribution, 848.
- beetle, Mexican, life history and control, Ala., 758.
- beetle, Mexican, new pest in Tennessee, 849.
- beetle, Mexican, summary, Ohio, 156.
- mildew on Limas, N.Y.State, 546.
- stem blight, new, notes, S.C., 648.
- weevil, four-spotted, biology, 850.

## Beans—

- as affected by sulphur, Oreg., 724.
- canned, anaerobic thermophile from, Mich., 459.
- cull, feeding value, Mich., 474.
- culture experiments, Can., 231.
- foreign, botanical determination, 23.
- hybrid, anthracnose and mosaic resistant, 650.
- Lima, yeast parasitic on, 650.
- manuring experiments, 29.
- observations and experiments, N.Y. State, 546.
- seed value, 636.
- strain selections, Minn., 139.
- varieties, Mont., 139.
- variety tests, 28.
- (See also Mungo and Velvet beans.)



- Bedbug—  
 bionomics of, 356.  
 tropical, life history, 556.
- Bedbugs, tropical, relation to relapsing fever, 53.
- Beef—  
 cattle business, relation to farm organization, 199.  
 in Union of South Africa, improving, 367.  
 production in Cotton Belt, U.S.D.A., 573.  
 scrap v. skim milk for egg production, Can., 472.  
 scrap, value for egg production, 273.  
 (See also Cattle, beef.)
- Beekeepers' Association of Ontario, report, 57.
- Beekeeping—  
 in Canada, Can., 158.  
 in coffee plantations, 663.  
 in Colorado, 158.  
 in France, 158.  
 studies, Minn., 157.  
 summary of information, 561.
- Bees—  
 anatomy, handbook, 762.  
 and honey, scoring exhibits in, 195.  
 diseases, Minn., 156.  
 diseases and treatment, 153, 582, 663.  
 diseases of, U.S.D.A., 158.  
 habits and activities, 458.  
 Isle of Wight disease, distribution, U.S.D.A., 158.  
 of Australia, catalogue, 359.  
 queen breeding and rearing, Minn., 157.  
 queen, rearing, 158.  
 temperature, Minn., 152.  
 treatise, 359.  
 v. spraying, 663.  
 value in fruit production, 561.  
 ventriculus, histology, 561; Minn., 156.
- Beet—  
 leafhopper as carrier of curly top, 660.  
 leafhopper in California, studies, 660.  
 pulp, dried, v. mangels for cows, Can., 375.  
 roots, insulin in, 767.  
 seed, germination, 740.  
 seed, testing and valuation, 238.
- Beetle—  
 Asiatic, in Connecticut, Conn.State, 50.  
 cloaked knotty-horn, biology, 661.
- Beetles, treatise, 359.
- Beets—  
 as oats substitutes for horses, 575.  
 cost of production in France, 191.  
 field or fodder. (See Mangels.)  
 formation of red pigment in, 224.  
 manuring experiments, R.I., 35.  
 mother, time for testing, 536.  
 net energy value in feeds, 572.  
 sugar. (See Sugar beets.)
- Belladonna—  
 alkaloids in, biology, 223.  
 culture, effect of sunlight, 223.
- Belt conveyors and elevators, treatise, 189.
- Benzoate renal function test, application to cattle, Minn., 181.
- Benzoic acid, adsorption of insulin on, 611.
- Benzol as motor fuel, 387.
- Benzoquinhydrone electrode, application to electrometric titrations, 507.
- Bephrata cubensis*, biology, 57.
- Beriberi—  
 basal metabolism in, 63.  
 human, and polished rice disease, 668.  
 in Japan, cause and treatment, 865.
- Berries. (See Fruits, small, and Raspberries, Strawberries, etc.)
- Betanaphthol, anthelmintic value, 380.
- Beverages, carbon dioxide content, 804.
- Bibliography of—  
*Agrotis segetum*, 255.  
 apple tissue, darkening, Calif., 410.  
 bacteria, life cycle, 728.  
 bark beetles, 255.  
 bean beetle, Mexican, 759.  
 bee diseases, 158.  
 birds, biology of, 355.  
 birds of North Dakota, 452.  
 boys' clubs, 298.  
 butter, fishy flavor in, Wis., 280.  
 carbohydrates, intermediary metabolism, 361.  
 Chermesidae, 556.  
*Clostridium botulinum*, effect on nervous system, 683.  
 corn, genetic factors, 430.  
 cotton testing, 234.  
*Cysticercus tenuicollis*, 880.  
 dairy waste disposal, N.Y.Cornell, 488.  
 dengue fever, 156.  
 electricity on the farm, 287.  
 field experiments, standardization, 733.  
 flax, culture and processing, 536.  
 flies, effect of food, 457.  
 girls' clubs, 298.  
 Hessian fly in Kansas, Kans., 54.  
 home economics, 695.  
 house fly, control, 255.  
 insects, control, 254.  
 insects in Brazil, 51.  
 insects of Sweden, 153.  
 Japanese beetle, control, N.J., 56.  
 land tenancy in Spain, 91.  
*Lecanium hesperidum*, 255.  
 lunar periodicity in reproduction, 510.  
 Malta fever, 684.  
 meteorology of Argentina, 208.  
 mineral metabolism, 664.  
 molds on cold storage meat, 763.  
 nicotine dust, 255.  
 nitrogen fixing power of soil, Utah, 119.  
 oats, growth, effect of seed treatment, 737.  
 oestrus and ovulation in mammals, 531.  
 ophthalmology, 379.  
 plant protection, 142.  
 plants, naturalization, 526.  
 poison ivy, 181.

## Bibliography of—Continued.

- potato leafhopper, Iowa, 155.  
 poultry breeds, large and small, 430.  
 rancidity in fats, 610.  
 rickets, experimental, 63.  
 scale insects, Mo., 257.  
 soils, bacteria in, 516.  
*Strongylus tetracanthus*, 81.  
 sugar cane irrigation, 484.  
 sulphur, value in agriculture, 20.  
 sweet potato weevil, Tex., 760.  
 Thysanoptera of North America., Fla., 660.  
*Tipula oleracea*, 255.  
 viruses, filterable, 78.  
 water glass, 615.  
 water requirements of crops, 735.  
 wireworm, false, 850.  
 worms and insects, 51.
- Bichlorid of mercury. (See Corrosive sublimate.)
- Bindweed, eradication, 533; Kans., 539.
- Bingham plastometer, use, 417.
- Biochemical procedure, application to plants, 21.
- Biological control, discussion, 657.
- Biology of home and community, treatise, 694.
- Biology, plant, treatise, 626.
- Biometrical methods, 128.
- Biometry, medical, and statistics, treatise, 729.
- Bios, synthesis by yeast, 363.
- Biotite, potassium content, 521.
- Birch borer, bronze, notes, Conn.State, 50.
- Birch tingitid, life history, 453.
- Birds—  
 Australian, parasites of, 356.  
 biology of, treatise, 355.  
 British, chronological list, 252.  
 captive wild, treatise, 885.  
 game, of British Islands, 355.  
 inland, treatise, 355.  
 land, of Illinois, 553.  
 metabolism in, 174.  
 migrations, relation to foot-and-mouth disease, 380, 786.  
 migratory game, local names, U.S. D.A., 150.  
 of Cuba, 252.  
 of India, 252.  
 of India, treatise, 356.  
 of Netherlands, 355.  
 of North Dakota, 452.  
 of Ohio, food habits, Ohio, 553.  
 of Pacific coast, treatise, 843.  
 of South Africa treatise, 252.  
 of West Virginia, 754.  
 physiology or reproduction, 867.  
 protection, directory of officials for, U.S.D.A., 355.  
 western, treatise, 754.  
 wild, propagation, treatise, 355.
- Black scale, control, 663.
- Blackberries, culture, 543.
- Blackberry orange rust, new type, 353.
- Blackberry orange rust, studies, 149.
- Blackhead in turkeys, Mont., 885.
- Blackleg—  
 immunization, present status, 881.  
 immunization products, grading, 682.  
 summary, U.S.D.A., 79.
- Blacktongue, studies, 284, 586.
- Blissus leucopterus*. (See Chinch bugs.)
- Blood—  
 agar, heated, nutritional values, 281.  
 analysis, calcium determination in, 312.  
 cells, red, hydrolytic cleavage products, separation, 108.  
 cells, red, specific gravity, 680.  
 constituents, relation to deficient diet, 274.  
 dried. (See Dried blood.)  
 filtrates, protein-free, making, modification, 112.  
 meal, vitamin content, Ohio, 573.  
 normal and diabetic, glycolysis, 569.  
 of pigeons in polyneuritis, 164, 860.  
 plasma, alkali reserve, in avitaminosis, 862.  
 plasma, inorganic elements, 615.  
 platelets as affected by vitamin A deficiency, 565.  
 platelets, technique of counting, 565.  
 pressure of dogs, 884.  
 pressure of fowls, 82.  
 sugar and ovulation, relation, 867.  
 sugar content, effect of glucose, 164.  
 sugar determination, methods, 806.  
 sugar, nature of, 765.
- Blue grass—  
 breeding experiments, Can., 433.  
 duration in meadows, N.Y.Cornell, 231.  
 germination, 434.  
 Kentucky, new leaf spot, 650.  
 seed, germination, 740.
- Blueberries, culture experiments, Minn., 138.
- Body organs, changes in relative weights, 773.
- Body, weight and longevity, 562.
- Bog xerophytes and soil toxins, 627.
- Boll weevil. (See Cotton boll weevil.)
- Bollworm. (See Cotton bollworm.)
- Bombus queens, confined, breeding experiments, 259.
- Bombyx mori*. (See Silkworms.)
- Bone solubility, effect of fineness, 412.
- Books on—  
 agricultural education, 897.  
 agricultural labor in France, 292.  
 agricultural machinery, 189, 588.  
 agricultural organization in United States, 590.  
 agriculture, American, 691, 792.  
 agriculture for high schools, 94.  
 agriculture for Kansas common school, 298.  
 agriculture, substances important in, 311.  
 Algeria, 93.



## Books on—Continued.

alkali soils, reclamation, 321.  
 alkaloids, 201.  
 animal diseases, clinical diagnosis, 379.  
 animal diseases in New Zealand, 76.  
 animal life in deserts, 355.  
 animal nutrition, 266.  
 animal parasites, 554.  
 animals, captive wild, diseases, 885.  
 animals, domestic, pathological anatomy, 379.  
 apples, boxed, marketing, 393.  
 bacteriology, 478.  
 bacteriology, agricultural, 526.  
 bacteriology, technique, 180.  
 bees, 359, 762.  
 beetles, 359.  
 belt conveyors and elevators, 189.  
 biology of home and community, 694.  
 biometry, medical, 729.  
 birds, biology of, 355.  
 birds, captive wild, diseases, 885.  
 birds, game, of British Islands, 355.  
 birds, inland, 355.  
 birds of India, 356.  
 birds of Netherlands, 355.  
 birds of Pacific coast, 843.  
 birds of South Africa, 252.  
 birds, western, 754.  
 birds, wild, propagation, 355.  
 botanical microtechnique, 626.  
 botanical names and terms, 627.  
 botany, Australian forest, 195.  
 botany of living plants, 727.  
 botulism, 167.  
 bridges, 387.  
 butter, 679.  
 butterflies and moths, 257.  
 capillaries, anatomy and physiology, 379.  
 chemistry, horticultural, 201.  
 chemistry, industrial organic, 801.  
 church in town and country, treatise, 794.  
 climates of the world, 807.  
 cloth, weaving, dyeing, and finishing, 695.  
 colloid chemistry, principles, 709.  
 concrete products, 186.  
 concrete, reinforced, 485.  
 concrete roads, construction, 587.  
 conifers, 344.  
 conifers, dwarf and slow-growing, 242.  
 corn and corn growing, 694.  
 cosmetics and perfumes, 308.  
 cotton, 694.  
 cows and milk production, 577.  
 Cucurbitaceae, 727.  
 dairy farming, 94, 676.  
 dairying, 780.  
 Delphiniums, 141.  
 ducks, natural history, 355.  
 economics of the household, 797.  
 electrons in chemistry, 608.

## Books on—Continued.

engineering formulas, design of diagrams for, 586.  
 engineering structures, 286.  
 entomology, 151.  
 entomology, medical, 453.  
 evergreens, 240.  
 excavation engineering, 286.  
 Fabre, J. H., 253.  
 fabrics, woven, 695.  
 farm accounting, 898.  
 farm implements and machinery, 189.  
 farm management, 590.  
 farm woodlands, 695.  
 farming, 94.  
 fermentation, alcoholic, 806.  
 filtration, industrial, 612.  
 fishery industries, 709.  
 flowers for cutting, 39.  
 flowers of Yellowstone National Park, 645.  
 food chemistry and preparation, 898.  
 foods, planning and preparation, 298.  
 forest insects, 555.  
 forest insects of Australia, 256.  
 forest mensuration, 647.  
 forest resources of the world, 141.  
 forestry for profit, 242.  
 fruit culture, 140.  
 furnace heating, 589.  
 game birds and wild fowl of British Islands, 355.  
 gardening, 139.  
 gardens of Switzerland, 239.  
 gear wheels, 687.  
 growth and senescence, chemical basis, 569.  
 hematology, 680.  
 highway transportation, 88.  
 hygiene, home and community, 797.  
 infection and resistance, 581.  
 insect anatomy, 253.  
 insects, 151.  
 insects, control, 253.  
 insects of Sweden, 153.  
 insects, social life among, 253.  
 laundering, 797.  
 livestock industry, American, 167.  
 livestock of Great Britain, 670.  
 logging, 444.  
 Lubin, D., 89.  
 lumber industry in United States, 344.  
 lumber, properties and uses, 838.  
 marketing, cooperative, 192.  
 meat industry, American, 167.  
 meat industry of world, 670.  
 meteorology, 313.  
 meteorology, simplified, 314.  
 motor transportation, 189.  
 nursery, small, establishment, 540.  
 nutrition, 852.  
 nutrition and clinical dietetics, 762.  
 organic syntheses, 709.  
 otters, 355.

## Books on—Continued.

- painting, principles and practices, 590.
  - pathology, 180.
  - perfumes and cosmetics, 308.
  - pigs, raising, 869.
  - plant biochemistry, 626.
  - plant biology, elements, 626.
  - plant cells, chemistry, 427.
  - plants, forcing, 834.
  - plants, house, 543.
  - plants, ornamental, 39.
  - potash, 724.
  - poultry, 576, 676.
  - pulp wood and wood pulp, 545.
  - range management, 167.
  - reports, preparation, 898.
  - roads, construction, 286.
  - roses, 239, 645.
  - rural church in South, 494.
  - rural economics, 891.
  - rural education, 494.
  - schools, rural, 596.
  - science remaking the world, 897.
  - sex determination, mechanism, 530.
  - slime molds, North American, 727.
  - spiders, British, 260.
  - spraying, 440.
  - structures, framed, 688.
  - sweet potatoes, 136.
  - textile chemistry, 308.
  - textile fabrics, 695.
  - town v. country, 892.
  - trees of Yellswone National Park, 645.
  - tuberculosis, 584.
  - vegetable gardening, 740.
  - vegetables, culture, 395.
  - veterinary ophthalmology, 379.
  - veterinary studies for agricultural students, 76.
  - weather proverbs and paradoxes, 415.
  - weather, world, 12.
  - wild flowers, bushes, and ferns, 240.
  - wood distillation, 587.
  - zoology, 252.
- Bordeaux mixture—**
- apple fruit and leaf injury from, 449.
  - effect on cherry trees, 300.
  - liquid, v. dry, N.Y.State, 546.
  - powdered, preparation, 710.
  - properties, 710.
  - use against leafhopper, Iowa, 154.
- Bordeaux-oil emulsion, value for citrus groves, U.S.D.A., 239.**
- Boric acid—**
- estimation in foods, 805.
  - preserved food poisonous to chickens, 788.
- Botanical—**
- microtechnique, treatise, 626.
  - names and terms, dictionary, 627.
- Botany—**
- Australian forest, textbook, 195.
  - of the living plant, treatise, 727.
- Botryodiplodia theobromae*, notes, 42.
  - Botryosphaeria dothidea*, notes, 143.
  - Botrytis—**
    - cinerea*, H-ion concentration changes induced by, 22.
    - cinerea* on strawberries, 48.
    - paeoniae*, notes, 355.
    - sp., notes, 547; Pa., 445.
    - sp. on figs, 751.
    - stephanoderis*, n. sp., description, 249.
  - Botulism and food preservation, 167.
  - Bovine reproduction, pathological phases, 681.
  - Box elder wood, red stain in, 843.
  - Box leaf miner, control, 559.
  - Boys' clubs, 298.
  - Bradspot and braxy, identity, 683.
  - Brambles, winter injury, Mass., 631.
  - Bran, autolyzed, as famine food, 561.  
(See also Wheat bran.)
  - Braxy and bradspot, identity, 683.
  - Bread—**
    - doughs, H-ion concentration in, 10.
    - interim report, 690.
    - (See also Flour.)
  - Breeding stock, scoring exhibits in, 195.  
(See Heredity and Plant and Animal breeding.)
  - Bremia lactucae*, notes, 748.
  - Bremus queens, confined, breeding experiments, 259.
  - Brewers' rice, feeding value, Miss., 69.
  - Brick cheese, ripening, bacteriological studies, 280.
  - Bricks, sand-lime and cement concrete, 88.
  - Bridges, highway, proposed loading for, 186.
  - Bridges, movable and long-span steel, treatise, 387.
  - Brome grass—**
    - awnless, breeding experiments, Can., 433.
    - duration in meadows, N.Y.Cornell, 231.
    - seed, testing, 740.
  - Bromoxylene blue, use as indicator, 311.
  - Brown rot—**
    - fungus, apothecia of, Md., 842.
    - of stone fruits, control, Oreg., 842.
  - Brown-tail moth, control, Conn.State, 50.
  - Brucella melitensis*—
    - group, recent terminology, 684.
    - serological classification, 183.
    - suggested term, 183.
  - Bruchus quadrimaculatus*, biology, 850.
  - Brunchorstia destruens* on pine, 150.
  - Buckwheat—**
    - effect of temperature range, 20.
    - germination, fertilizer injury to, N.J., 216.
    - growth, relation to seed weight, 134.
    - nutritive value, 160.
    - variety tests, Can., 533.
  - Bud mutation in citrus, 822.
  - Buffaloes, breeding experiments, 275.



- Building stones of Kentucky, 686.  
 Bulbs, relation to nematodes, 452.  
 Bulls as carrier of abortion, West.Wash., 184.  
   (See also Sires.)  
 Bumblebees, interrelation with Psithyrus, 153.  
*Bunostomum trigonocephalum*, free-living larval stages, 253.  
 Bunt control, Calif., 43.  
   (See also Wheat smut, stinking.)  
*Bupalus piniarius*, gradation, effect of station and climate, 255.  
 Butanol from fermentation of corn, 12.  
 Butter—  
   antirachitic properties, 771.  
   as carrier of disease, 878.  
   boxes, woods for, Calif., 782.  
   fat. (See Milk fat.)  
   fishy flavor in, Wis., 279.  
   keeping quality, effect of microorganisms, 476.  
   making, better cream for, Ind., 179.  
   making, neutralization of cream for, N.Y.Cornell, 76.  
   making, studies, 782.  
   quality, relation to amino and ammonia nitrogen in, 476.  
   soluble nitrogen compounds in, 805.  
   treatise, 679.  
 Butterflies and moths, treatise, 257.  
 Buttermilk—  
   condensed, feeding value, Wash.Col., 277.  
   dried, feeding value, Tex., 70.  
   fat, determination in, 10.  
   feeding value, Can., 370.  
   value for egg production, 273.  
 Butyric fermentation of corn, gases from, 12.  
*Byturus unicolor*, notes, 51.  
*Byturus unicolor*, studies, 848.  
 Cabbage—  
   and kale hybrids, 633.  
   blackleg, occurrence, 650.  
   diseases, popular descriptions, U.S.D.A., 45.  
   insects, studies, N.Y.State, 555.  
   leaves, 3-carbon sugar from, 309.  
   maggot experiments, Conn.State, 50.  
   maggot in seed beds, control, N.Y.-State, 555.  
   maggot, life history studies, Pa., 454.  
   overhead irrigation studies, Minn., 139.  
   production, Calif., 741.  
   seedlings, soil mixtures for, Pa., 440.  
   solidity of head, factors affecting, Pa., 439.  
   storage cellar, Bordeaux dust for, Can., 339.  
 Cacao—  
   butter, adulteration, 205, 805.  
   culture, 637.  
   diseases, 42.  
   diseases in Trinidad, 354.  
   origin and flowering habit, 343.  
   products, fat determination in, 196.  
*Cucoecia*—  
   *fumiferana*, notes, 756.  
   *parallela*, life history notes, Mass., 659.  
 Cactus, prickly pear—  
   as fodder, 774.  
   dissemination and eradication, 639.  
 Cadelle, biology, 457.  
*Calandra granaria*. (See Granary weevil.)  
 Calcium—  
   absorption by plants, 524.  
   adsorption, relation to soil reaction, 512.  
   and nitrogen relation in plants, 524.  
   arsenate, available supply in United States, 554.  
   arsenate, relation to boll weevil control, 851.  
   arsenate, use on cotton, U.S.D.A., 259.  
   assimilation, dietary factors in, 678.  
   assimilation, factors causing, 277.  
   carbid from power alcohol, 287.  
   caseinate and lime sulphur, fungicidal value, 346.  
   concentration in blood, effect of sunlight, 63.  
   content of oats, 232.  
   cyanamid, decomposition in south Indian soils, 722.  
   cyanamid, fertilizing value, 423.  
   cyanamid, hydrolysis products, 9.  
   deficiency, effect on parathyroid glands, 162.  
   determination in serum, 112.  
   determination, nephelometric method, 312.  
   effect on alfalfa, 726.  
   effect on luplines, 426.  
   excess, effect on skeleton, 856.  
   in blood, effect of ultraviolet light, 260.  
   in human milk, racial variations, 562.  
   in milk, 609.  
   in milk, relation to cheese making, 378.  
   in serum of rachitic children, effect of light, 466.  
   metabolism, effect of cellulose and protein, 571.  
   metabolism, effect of cod liver oil, 262, 570.  
   metabolism in rickets, 669.  
   of almonds, utilization by man, 764.  
   oxid, effect on sulphate loss from soil, 522.  
   salts, availability, 362.  
   salts, effect on orange trees, Calif., 327.  
   sulphate. (See Gypsum.)  
   value in the diet, 764.  
   (See also Lime.)  
 Calcium-magnesium interchange, 819.  
 Calf meals, feeding value, Wash.Col., 277.  
 Caliche, nitrate recovery from, 323.  
 California—  
   Station, notes, 497, 899.  
   University, notes, 96, 497, 899.

## Calves—

- beef, wintering, Can., 573.
- cost of raising, Can., 377.
- feeding and management, Wash.Col., 276.
- feeding experiments, Can., 781.
- growth and nutrition, 275, 579.
- management, 781.
- raising, minimum milk requirement, 781; Minn., 175.
- raising on limited milk, 578.
- self-feeders for, 579.

Camphor, culture and preparation of products, 140.

*Camponotus herculeanus japonicus*, parasite of, 459.

Canal cleaning, economies in, 286.

Canaliculi of Holmgren, significance, 222.

## Cancer—

- of plants, studies, 745.
- of the ear of sheep, 585.

Cane pest, control, 457.

Cane seed v. corn, feeding value, Kans., 67.  
(See also Sugar cane.)

Canine typhus, notes, 253.

Canker, European, on Pacific slope, 148.

Canned food with boric acid, effect on poultry, 788.

Cantala, grading, baling, and inspection, 434.

Cantaloups. (See Muskmelons.)

## Canton—

- fibers, grading, baling, and inspection, 434.
- mud, composition, 319.

Capillaries, anatomy and physiology, treatise, 379.

## Capon—

- endogenous metabolism, 576.
- value, Mo., 876.

## Carbohydrate—

- insulin requirement in diabetes, 766.
- metabolism in avitaminosis, 163, 863.
- with three carbon atoms from cabbage, 309.

## Carbohydrates—

- effect on nitrogen fixing power of soil, Utah, 119.
- intermediary metabolism, 361.
- research problems in, 505.

## Carbon—

- absorption by roots, 628.
- assimilation, 427.
- assimilation of plants, early products of, 525.
- cycle in nature, Mich., 411.
- determination in vegetable mold, 202.
- dioxid additions to soils, effect, 625.
- dioxid in beverages, 804.
- disulphid fumigation for Japanese beetle, N.J., 56.
- tetrachlorid, effect of simultaneous administration of magnesium sulphate, 684.

## Carbon—Continued.

tetrachlorid, pharmacology and toxicology, 282.

tetrachlorid, studies, 380.

Carbonate salts in soil, absorption factor, 813.

Carbonates, effect on sulphate loss from soil, 522.

Carnation rust, notes, 547.

Carob beans, chemical and structural study, U.S.D.A., 501.

Carotin determination, 713.

Carotinoid pigments, biochemistry, Minn., 108.

Carpet beetles, control, U.S.D.A., 56.

Carpet moth, control, U.S.D.A., 53.

*Carpocapsa pomonella*. (See Codling moth.)

*Carpocapsa splendana* on chestnuts, 661.

## Carrot—

- blight, control, 546.
- blight, studies, Mass., 650.

## Carrots—

- antirachitic properties, 771.
- manuring experiments, R.I., 35.
- overhead irrigation studies, Minn., 139.
- thinning, Can., 440.
- variety tests, Can., 432, 533.
- with hay, digestibility, Mass., 168.

## Casein—

- commercial, preparation, 680.
- digestibility in vitro, 360.
- hydrolytic cleavage products, separation, 108.
- purification, effect on value, 763.

Casein-lime spreader, value, 346.

Cashew nut oil, composition, 308.

Castor oil seeds, development of aleurone grains in, 222.

## Castration—

- effect on development, 825.
- effect on skeleton of animals, 165.

## Catalase—

- activity as indicator of nutritive condition of fruit tree, 36.
- activity of apples in storage, 542.
- content of seed and viability, 507.

Catarrh, nasal, among fowl, 878.

Caterpillar, puss, effects of its sting on man, U.S.D.A., 258.

(See also Tent caterpillar.)

Cats, age and chemical development, 569.

## Cattle—

Aberdeen-Angus, history and origin, 368.

age and chemical development, 569.

beef, barns, U.S.D.A., 190.

beef, feeding experiments, Can., 775; Mont., 170.

(See also Steers.)

beef, raising in Cotton Belt, U.S.D.A., 573.

beef, wintering, S.C., 672.

Brahman, U.S.D.A., 368.



## Cattle—Continued.

- breeding in Union of South Africa, 367.
- breeds, evolution, 573.
- crisis in Argentina, U.S.D.A., 293.
- dairy. (*See Cows.*)
- diseases, Ill., 73.
- diseases causing sterility and abortion, 78.
- (*See also specific diseases.*)
- draft, feeding experiments, 672.
- fattening, Ohio, 170.
- feeding experiments, 170; Kans., 65.
- feeding experiments in Rhodesia, 270.
- (*See also Cattle, beef, Calves, Cows, and Steers.*)
- feeding, law of diminishing increment, 199.
- Guernsey Advanced Registry, effect of age on milk yields, Me., 74.
- Holstein, inheritance of spotting, 631.
- Holstein, Kreimhild herd, 676.
- identification by nose prints, 269.
- industry in Rhodesia, 171, 469.
- inheritance of white markings in, 731.
- plague. (*See Rinderpest.*)
- poisoning. (*See Livestock poisoning, Plants poisonous and specific plants.*)
- Shorthorn, colors of, 128.
- sterility in, pathology, 788.
- surface area, determination, 268.
- (*See also Calves, Cows, Heifers, and Steers.*)
- Cauliflower—
  - black rot, studies, N.Y.State, 546.
  - disease, obscure, studies, N.Y.State, 546.
  - manuring experiments, R.I., 35.
- (*Cecidomyia*) *Mayetiola destructor*. (*See Hessian fly.*)
- Cedar—
  - incense, susceptibility to fire injury, 544.
  - white, of Dismal Swamp, 744.
- Celery—
  - blanching tests, Can., 440.
  - blights, control, 651.
  - damping-off in greenhouses, 549.
  - insulin in, 767.
  - mosaic, description, 747.
  - premature seeding, 300.
  - storage cellar, Bordeaux dust for, Can., 339.
  - studies, S.C., 643.
  - yellow-resistance strain, 651.
- Cell wall structure of cotton hairs, 629.
- Cells, living, oxidative mechanism in, 461.
- (*See also Plant cells.*)
- Cellulose—
  - constitution, 505.
  - digestion by intestinal flora of man, 763.
  - effect on inorganic metabolism, 571.
  - of wood and cotton, fundamental difference, 9.

## Cellulose—Continued.

- standard cotton, preparation and analyses, 206.
- structure, determiners, 629.
- wood, acetolysis reaction, 509.
- wood, nature of, 206.
- Cement, disintegration in sea water, 187.
- (*See also Concrete.*)
- Cenangium abietis* on pine, 150.
- Cephaleuros mycoidea*, notes, 447.
- Cephaleuros virescens*, notes, 42.
- Cephalin of brain in avitaminosis, 862.
- Cephalosporium sacchari*, notes, 546.
- Ceratitis capitata*, notes, 54.
- Ceratonis siliqua*. (*See Carob.*)
- Ceratostomella* sp., penetration into hardwood, 656.
- Cercospora*—
  - melongenae* n.sp., notes, 748.
  - personata* on peanut, 146.
  - spp., notes, 248.
- Cercosporina fusicola* n.sp., description, 248.
- Cereal—
  - chemistry, phases, 710.
  - diseases. (*See specific hosts.*)
  - Division, activities, Can., 231.
  - fungus diseases, control, 245.
  - products, protecting from insect attack, Minn., 152.
  - rots, studies, Minn., 144.
  - rust, studies, Minn., 144.
  - rusts, relation to vegetative vigor of host, 43.
  - (*See also specific host plants.*)
  - Septoria diseases, 648.
  - smut. (*See specific host plants.*)
  - take-all disease, 549, 746.
- Cereals—
  - breeding experiments, recording, 828.
  - breeding in Italy, 333.
  - germination, 238.
  - hybridization, Alaska, 533.
  - interim report, 690.
  - production in Spain, 795.
  - recent Strampelli, 437.
  - response to nitrogenous fertilizers, 232.
  - varieties, testing, 827.
  - winter resistance, 231.
- Ceroplastes, parasitism, 155.
- Cestodes, summary, 51.
- Ceuthorrhynchus pleurostigma*, studies, 57.
- Chaetochloa lutescens*, bacterial disease, 349.
- Chaetocnema* spp., notes, 747.
- Chaff from Volga region, composition, 169.
- Chalcid wasp, structure and development, 356.
- Chalcis calliphorae*, notes, 359.
- Chalcis ovata*, notes, U.S.D.A., 258.
- Chalk and lime, relative effects, 820.
- Chayote, culture and uses, U.S.D.A., 139.
- Cheese making—
  - effect of calcium in milk, 378.
  - pasteurization of milk for, 679.

- Chemical—  
 engineering, processes in, 612.  
 raw materials from plant products, 608.
- Chemistry—  
 applied, differential equations in, 709.  
 horticultural, treatise, 201.  
 in cereal industries, phases, 710.  
 in control of plant enemies, 710.  
 industrial organic, treatise, 801.  
 relation to livestock industry, 608.  
 relation to national defense, 196.
- Chenopodium oil, value against chicken nematode, Minn., 152.
- Chermes—  
*abietis*, notes, Conn.State, 50.  
*cooleyi*, life history, 556.  
*pinicorticis*, natural control, 844.
- Cherries—  
 breeding experiments, Can., 36.  
 pollination, 442.  
 size as affected by alkaline sprays, 751.  
 variability in fruit and leaves, 429.  
 variety tests, Can., 440.  
 wild black, in northern Pennsylvania, 242.
- Cherry fruit fly, control, 844.
- Cheshunt Compound, preparation, 352.
- Chestnuts—  
 infestation by *Carpocapsa splendana*, 661.  
 sweet, culture experiments, Minn., 138.
- Chicken—  
 nematode, control, Minn., 152.  
 pox and roup, control, 586, 685.  
 pox vaccination, 879.
- Chickens—  
 crate fattening, Can., 472.  
 fattening, economic factors, 274.  
 growing in confinement, 372.  
 hereditary relation of dominant white and blue, 330.  
 natural and artificial brooding, U.S.D.A., 780.  
 standard varieties, U.S.D.A., 72.  
 susceptibility to snakeroot poisoning, Ind., 181.  
 (See also Chicks, Fowls, Hens, and Poultry.)
- Chicks—  
 cost of raising, Can., 373.  
 diseases of, Mo., 884.  
 feeding methods, Can., 777.  
 growing, effect of ration on later egg production, W.Va., 71.  
 leg weakness in, West.Wash., 576.  
 minerals for, 872.  
 nutritional requirements, 780.  
 vitamin requirements, 373.
- Chiggers, North American, distribution and nomenclature, 762.
- Child—  
 care and nursing in the home, 395.  
 care, teaching to seventh-grade girls, 695.
- Child—Continued.  
 labor in North Dakota, 493.  
 welfare in West Virginia, 194.
- Children—  
 backward, effect of improved feeding, 855.  
 feeding. (See Infants, feeding.)  
 four-year old, menus for a week, 161.  
 undernourished, means of determining, 854.  
 undernourished, value of extra milk ration, 855.  
 underweight, value of milk and oranges to, 563.  
 (See also Boys, Girls, and Infants.)
- Chili collar rot, notes, 244.
- Chinch bugs, construction and operation of barriers for, 53.
- Chinese fish pond mud, composition, 319.
- Chironomidae of Belgium, 358.
- Chironomus cristatus*, life history, 455.  
 (*Chloridea*) *Heliothis obsoleta*. (See Cotton bollworm.)
- Chlorids in blood plasma, determination, 615.
- Chlorin—  
 effect on plants, 428.  
 germicidal action, 679.  
 in human milk, racial variations, 562.
- Chlorophyll in plastids, condition, 126.
- Chlorosis, effect on composition of fruit, 248.
- Choanotaenia infundibuliformis*, notes, 82.
- Cholera immunization, oral route for, 478.
- Chondriome theory, relation to structure of plant cell, 223.
- Chromium effect on wheat, 820.
- Chromogens, oxidation, formation of red pigment from, 224.
- Chromosome—  
 behavior in partially sterile wheat hybrids, Me., 26.  
 numbers in marsupials, 329.
- Chromosomes—  
 arrangement of genes, theory, 129, 730.  
 crossing over of genes, interference in, 129.  
 location of genes for characters, 823.  
 morphological studies, 225.  
 of species of *Drosophila*, comparison, 528.  
 X as affected by X-rays, 226.
- Chrysanthemums, hardy varieties, U.S.D.A., 140.
- Chrysomya macellaria*, notes, 482.
- Chufa, analyses, 408.
- Chufa oil, constituents, 408.
- Cicada, periodical, digestive system, 257.
- Cider vinegar, home production, Iowa, 113.
- Cigarette beetle, notes, V.I., 555.
- Cimex rotundatus*, life history, 556.
- Citric acid—  
 as source of carbon for fungi, 630.  
 manufacture, 313.



## Citrus—

- blast, relation to weather, 752.
- bud mutation in, 822.
- die-back in Bombay, 249.
- die-back, notes, 244.
- diseases. (*See* Lemon, Orange, etc.)

## Citrus fruits—

- culture experiments, Miss., 38.
- culture in Gulf States, U.S.D.A., 38.
- freezing, 644.
- gases for coloring, tests, P.R., 540.
- thrips affecting, 555.
- (*See also* Lemons, Oranges, etc.)

## Citrus—

- grafting, 543.
- industry in lower Rio Grande Valley, 38.
- mealybug, summary, Mich., 454.
- orchards, tree records for, Calif., 239.
- pectin extracts, jellying power, 508.
- pests in Brazil, 555.
- Phomopsis in California, 752.
- plants, introduction, quarantine procedure, U.S.D.A., 743.
- psylla, life history and habits, 257.
- psyllid, new species, 155.
- scab, control, P.R., 552.
- scab epidemics, relation to weather, 752.
- stem-end rot, control, U.S.D.A., 149.
- tambora disease, 243.
- trees, spraying equipment for, 659.
- white snails affecting, 657.

## Cladosporium from stone fruits, cross-inoculation, 656.

## Cladosporium—

- herbarum in soil, activities, 620.
- paeoniae, notes, 355.
- sp., notes, 547.

## Clams, canned, analyses, Conn.State, 160.

## Clasterosporium carpophilum, control, 451.

## Claviceps purpurea, studies, 143.

## Claviceps spp., distribution, 545.

## Clay—

- and sand, apparatus for separating, 14.
- colloidal, chemical nature, Mo., 210.
- deposits of Kentucky, 686.
- flocculation, 810.
- in its relation to piles, experiments, 86.
- mud, physical properties, 117.
- physical properties, 87.
- plasticity, measuring, 417.
- production in United States, 727.
- soils, physical and chemical studies, 511.

## Click beetle, notes, 457.

## Climate—

- and plant growth, relation, 807.
- and vegetation of a hill, effect of slope exposure, 526.
- and wheat yields at Maryland Station, 641.
- effect on fruit trees, U.S.D.A., 114.
- effect on wheat production in Nebraska, 715.

## Climate—Continued.

- of Brazil, 511.
- of Great Plains, 207.
- of Khartum, 511.
- of Netherlands Indies, 416.
- relation to sun spots, 315.
- (*See also* Meteorology.)

## Climates—

- of the world, exercises and laboratory manual, 797.
- of the world, treatise, 807.

## Climatic cycles, 415.

## Climatological—

- and meteorological bibliography of Argentina, 208.
- data. (*See* Meteorological observations.)

## Climatology, normals, secular trends, and climate changes, U.S.D.A., 114.

## Clostridium botulinum—

- complement fixation studies, 786.
- effect of spices, 366.
- effect on nervous system, 682.
- in Wisconsin, 682.
- pure cultures from single cells, 682.
- type C in poultry, Ill., 383.
- (*See also* Bacillus botulinus.)

## Cloth, weaving, dyeing, and finishing, treatise, 695.

## Clothes moths, control, U.S.D.A., 53.

## Clothing and textiles, graduate work in, 297.

## Clover—

- and alfalfa seed movement, Mich., 496.
- bacterial leaf spot, studies, 348.
- culture experiments, Alaska, 532.
- fertilizer experiments, Minn., 120, 121.
- hay, fertilizer experiments, Can., 817.
- hay, yields, Can., 432.
- immigrant, species, 829.
- insects affecting, N.Y.Cornell, 57.
- Mediterranean, varieties new to United States, 30.
- mosaic, studies, 651.
- powdery mildew, notes, Ohio, 145.
- rate of manuring tests, Minn., 120, 121.
- red, breeding experiments, Can., 433; Minn., 132.
- red, culture, U.S.D.A., 435.
- red, effect of temperature range, 20.
- red, manuring experiments, 29.
- red, winter habit, 333.
- root rot, notes, Ohio, 145.
- seed, domestic v. foreign, 830.
- seed from southern Europe, value, Ind., 435.
- seed, germination, 740.
- seed, Italian red, unsuitability, U.S.D.A., 829.
- seed, methods of covering, 34.
- seed, red, foreign v. home-grown, 435.
- Swedish red and Silesian, yields, 334.
- sweet. (*See* Sweet clover.)
- uptake of nutrients and storage, 333.
- utilization, Minn., 121.

## Clover—Continued.

- v. timothy rotation experiment, N.Y. State, 421.
- varieties, characteristics, 237.
- weed seeds for suckling pigs, 372.
- worm, green, on soy bean, Ohio, 256.

## Clovers, analyses, Oreg., 7.

## Club work. (See Boys' clubs and Girls' clubs.)

## Cob construction, papers on, 88.

## Coccidae—

- of British Islands, review, 155.
- of Florida, 155.

*Coccothra spissana*, notes, 156.

## Cockchafer larvae, destruction, 457.

## Cockerels—

- caponizing, Mo., 873.
- feeding experiments, Can., 778.
- organs, variation and correlations in, 779.

## Cocklebur poisonous to livestock, U.S.D.A., 77.

## Cocoa—

- culture in British colonies, 442.
- detection in feeds, 468.

## Coconut—

- but rot in Philippines, 656.
- bud rot, two types, 149.
- caterpillar in Ceylon, notes, 455.
- meal proteins, nutritive value, 267.
- oil, antirachitic properties, 771.
- oil, hydrogenation, 309.

## Coconuts—

- fertilizer experiments, P.R., 540.
- insects affecting, 556.
- pests affecting, 256.

## Cod liver oil—

- effect on calcium and phosphorus metabolism, 262.
- effect on inorganic metabolism, 570.
- effect on vitamin A in milk, 568.
- effective constituent, separation, 801.
- growth-promoting and antirachitic values, relation, 771.
- industry in Newfoundland, 665.
- manufacture and food value, 267.
- potency of vitamin in, 664, 665, 858.
- therapeutic uses, history, 263.

## Codling moth—

- chart showing effect of temperature on oviposition, 51.
- control, 357.
- in Arkansas, life history, Ark., 558.
- papers on, 844.

## Coffee—

- berry beetle, fungi affecting, 249.
- blossom, biological study, 39.
- culture, 637.
- detection in feeds, 468.
- feathering of cream in, 852.
- fertilizer experiments, P.R., 540.
- pollination by bees, 663.
- refuse, digestibility, Mass., 168.

## College of Agriculture, Nanking, China, history, 596.

## Colleges. (See Agricultural colleges.)

*Colletotrichum*—

- circinans*, notes, 143.
- gossypii*, notes, 349.
- lindemuthianum*, parasitism of, Minn., 42.
- nicotianae*, n.sp., notes, 248.
- pisi*, description, 146.
- pisi* on peas, 652.
- theobromae*, notes, 42.

## Colloid chemistry—

- application to oils and fats industry, 801.
- principles, treatise, 709.
- relation to agriculture, 196.

## Colloidal—

- lead arsenate, preparation and properties, 608.
- material in soils, determining, U.S.D.A., 811.
- properties of soil, studies, 417.

## Colloids in soil, determination and valuation, 618.

## Colonization in Algeria, 793.

## Colonization in Norway, 193.

## Color—

- in plants, 728.
- inheritance in fowls, 227, 330.
- inheritance in leaves of rice and barley, 330.
- inheritance in Shorthorn cattle, 128.
- inheritance of seed coat of sorghum, 431.
- inheritance, unusual, in a steer, 128.
- laboratory, work of, 714.
- of flowers, optimum altitude for, 427.
- transformation due to oxidation, 224.

## Colostrum—

- feeding, effects, 883.
- importance to newborn calf, 479.
- importance to newborn infant, 562.

## Colts—

- breaking and training, U.S.D.A., 372.
- growth curves, Mo., 467.

## Columba fly, devastations by, 156.

## Community improvement. (See Rural community.)

## Complement—

- deficiency, hereditary behavior, Vt., 328.
- fixation test, value in identifying *Bacillus botulinus*, 64.
- fixing antibodies in normal horses, 383.

## Compost, use on meadows, 434.

*Compsocryptus retentor*, notes, U.S.D.A., 258.

## Concrete—

- fatigue of, 790.
- mixing and use on the farm, 187.
- pipe, reinforced, design, 86.
- products, manufacture and use, treatise, 186.
- reinforced, treatise, 485.
- roads, construction, treatise, 587.
- slabs, effect of repeated loads, 186.
- strength, 385.



## Coniferous—

- nursery, fertilizer experiments, 443.
- seedlings, damping-off disease, Minn., 49.
- seedlings, effect of shading, 443.
- seeds, germination, 343.
- wood, sawdust, gelatinization, 509.

## Conifers—

- dwarf and slow-growing, treatise, 242.
- pathological resin canals in, 753.
- treatise, 344.

Connecticut State Station, report, 696.

*Conotrachelus*—

- aguacatae* n.sp., description, 458.
- nemuphar*. (See *Plum curculio*.)
- sapotae* n.sp., description, 458.

*Contarinia tritici*. (See Wheat midge.)

Cooking by electricity, 58.

Cooperation. (See Agricultural cooperation.)

Cooperative societies in the Punjab, 795.

## Copper—

- carbonate dust for smut control, 347, 649.
- carbonate dust, use, Minn., 144.
- carbonate for wheat seed treatment, Calif., 44.
- determination in gelatin, 712.
- in dairy products, solubility, 178.
- in fungicides, 245, 446.
- sulphate dust, dehydrated, use, Minn., 148.
- sulphate, effect on wheat growth, Calif., 43.
- sulphate solution for smut control, 347.

Copra cake, feeding value, 367.

## Cork—

- oak in Tunis, 744.
- production in Spain, 40.

## Corn—

- acidity, relation to vegetative vigor, 328.
- analyses, Oreg., 7.
- and corn growing, textbook, 694.
- and cottonseed meal, feeding value, Miss., 69.
- and sorghum, relative water requirements, Kans., 28.
- and soy beans, culture, Miss., 828.
- and soy beans, feeding value, Miss., 70.
- and tankage, feeding value, Miss., 69.
- and tankage v. rice polish and tankage for pigs, Miss., 69.
- as affected by cyanamid, U.S.D.A., 622.
- as affected by sulphur, Oreg., 724.
- at different stages, vitamins in, 769.
- bacterial wilt, insect dissemination, 747.
- borer, European, notes, 51; Conn. State, 50.
- borer, European, resolutions concerning, 155.
- borer, European, summary, Ill., 357.
- breeding, Wis., 435.

## Corn—Continued.

- breeding experiments, Minn., 132; P.R., 533; S.C., 637.
- breeding in Italy, 333.
- butyric fermentation, gases from, 12.
- commercial outlook, 594.
- crosses, effects of selection on yield, U.S.D.A., 830.
- culture experiments, 828.
- culture experiments in Sweden, 735.
- dent, origin, 234.
- double kernel in, morphology, N.Y.-Cornell, 24.
- dry-rot, studies, Iowa, 145.
- ear and root parasite, 548.
- earworm, notes, 51, 546.
- earworm resistant variety, V.I., 533.
- earworm, wintering, Conn.State, 50.
- feeding value, Ohio, 170.
- fertilizer experiments, Minn., 120, 121; West.Wash., 520.
- for silage, cost studies, Can., 432.
- from Volga region, composition, 169.
- Fusarium, notes, 648.
- genetical research with, 430.
- germination, fertilizer injury to, N.J., 215.
- green, effect on flavor of milk, U.S.D.A., 376.
- head smut in Washington, 146.
- heritable characters, 528.
- hogging down experiments, N.Dak., 67.
- inheritance of blotch leaf in, N.Y.-Cornell, 24.
- inheritance of dwarfing in, 129.
- kernels, freezing point during ripening, Minn., 126.
- leaves, temperature, 425.
- meal v. peanut meal for milk production, Can., 375.
- oil, phytosterols in, N.Y.State, 408.
- physiological stability, 628.
- proteins, nutritive value, 267.
- rate of manuring tests, Minn., 120, 121.
- rotation experiments, N.Y.State, 422; R.I., 520.
- rust, studies, 747.
- seed, diastatic activity, 222.
- seed production, U.S.D.A., 132.
- seedling blight, relation to soil temperature, 548.
- self-pollinating, new method, 333.
- silage. (See Silage.)
- smut resistant varieties, breeding, Minn., 144.
- smut, studies, Minn., 143.
- soft ear, preserving, Iowa, 64.
- soft, in Iowa, cause, 435.
- stover, fertilizing value, Minn., 121.
- sweet. (See Sweet corn.)
- v. cane seed, feeding value, Kans., 67.
- v. grain sorghum, feeding value, Tex., 66.
- varieties, Miss., 828; S.Dak., 638.

## Corn—Continued.

- varieties for silage, Can., 533.
- varieties for silage, milk-producing value, 474.
- variety tests, 828; Can., 432; Mont., 133; S.C., 637; U.S.D.A., 132.
- water requirements, 828.
- wild, a weed in Indiana, 641.
- yields, comparative, competition as source of error in, 233.

Corncoobs, furfural manufacture from, 505, 806.

Cornstalk boring noctuid, paper on, 846.

## Corpus luteum—

- effect of uterus extirpation, 826.
- relation to sexual cycle, 635.

Correlation data, interpretation, Tex., 729.

Corrosive sublimate for cabbage, Pa., 454.

## Corticium—

- javanicum*, notes, 42.
- vagum*, pathogenicity, effect of soil temperature, 348.
- vagum solani*, notes, 550.

*Carynebacterium equi*, proposed name, 685.

*Corythucha pallipes*, life history, 453.

Cosmetics and perfumes, treatise, 308.

*Cosmopolites sordidus*, summary, 661.

## Cost of production—

- of crops and milk in France, 191.
- of crops and milk in Scotland, 191.
- (See also *specific crops*.)

*Cothonaspis gilletei*, notes, Pa., 454.

## Cotton—

- action of light on, 436.
- airplane dusting, U.S.D.A., 658.
- American, classification, U.S.D.A., 639.
- and flax fibers, studies, 134.
- angular leaf spot, control, 549.
- anthracnose, notes, 349.
- as affected by cyanamid, U.S.D.A., 622.
- boll weevil, control, 57; S.C., 663; U.S.D.A., 259, 658.
- boll weevil control, discussions, 399.
- boll weevil, control in Arkansas, 663.
- boll weevil poisoning, progress, Miss., 760.
- boll weevil problem, Ark., 850.
- bollworm, notes, 533.
- bollworm, pink, disinfecting seed for, 53.
- bollworm, pink, distribution in Porto Rico, 357.
- bollworm, pink, of *Thurberia*, 660.
- bollworm, pink, situation in California, 357.
- breeding and depression of lint length, 28.
- breeding experiments, S.C., 637.
- cellulose, standard, preparation and analyses, 206.
- Committee, Indian Central, activities, 830.
- compression into plugs, 436.
- culture, Tenn., 31.
- culture experiments, 28, 828.

## Cotton—Continued.

- culture in Kentucky, 830.
- desirable staple in, 535.
- Diplodia boll rot, notes, S.C., 648.
- dusting experiments, 458.
- dusting machinery, discussion, 57.
- equilibrium moisture, 535.
- experiments, Miss., 735.
- fertilizer experiments, 28; Miss., 828; S.C., 621, 637.
- fibers, measurements, 234.
- fineness in, estimating, 736.
- germination, fertilizer injury to, N.J., 216.
- hairs, breaking load, 736.
- hairs, cell-wall structure, 629.
- hairs, clinging power, 31.
- hairs, convolutions in, 831.
- hybrid, segregation and correlation of characters in, U.S.D.A., 24.
- improvement in Bengal, 828.
- inbreeding, importance, 732.
- industry in north Brazil, 830.
- inheritance in, 531.
- inheritance of number of boll loculi in, 632.
- insects affecting, 51; V.I., 555.
- investigations, S.C. 638.
- irrigation experiments, U.S.D.A., 132.
- Jassid-resistant, 436.
- linkage relations in, 633.
- linters, properties, 505.
- marketing in Arkansas, cooperative, 593.
- materials, mechanical testing, 234.
- methylene blue absorption by, 413.
- pests affecting, 256.
- pests, minor, in Egypt, 52.
- Pima, uses, U.S.D.A., 435.
- plants, growth of fruiting parts, 30.
- plasticity, 830.
- production in irrigated areas of South Australia, 535.
- production under boll-weevil conditions, S.C., 639.
- properties and uses, 534.
- ratooning and fertilizer experiments, U.S.D.A., 132.
- raw, measurable characters, 735.
- relation to temperature and rainfall, 415.
- research in British Empire, editorial, 701.
- root rot control, U.S.D.A., 146.
- root rot fungus, habits, 747.
- rotation experiments, U.S.D.A., 132.
- Sea Island, variety tests, 28.
- seed, disinfecting, 53.
- seed, germination, 740.
- seed, gossypol in, variation and relation to oil in, 111.
- seed hairs, cell-wall structure, 629.
- seed production, U.S.D.A., 132.
- seed, vitality, 349.
- (See also Cottonseed.)
- seeding experiments, U.S.D.A., 132.



## Cotton—Continued.

- spacing experiments, U.S.D.A., 132.
- Standards Act, regulations, U.S.D.A., 293.
- stem weevil, notes, 57.
- Texas, correlation of characters, 633.
- Texas, root rot, control, Tex., 45.
- treaties, 694.
- varieties, Miss., 828; S.C., 639.
- variety tests, 28, 828; S.C., 637; U.S.D.A., 132.
- warehouses, regulations, U.S.D.A., 293.
- wilt, a seed-borne disease, 748.
- wilt, control by potash fertilizers, 45.
- wilt resistant varieties, 243.

## Cottonseed—

- feeding value, Tex., 70.
- globulin, digestibility in vitro, 360.
- meal and corn, feeding value, Miss., 69.
- meal and hulls, feeding value, Tex., 775.
- meal, digestibility, Mass., 168.
- meal, feeding value, Mich., 474; Miss., 65; Tex., 70.
- meal, toxicity, effect of autocloving, 468.
- oil, catalytic hydrogenation, 610.
- oil, phytosterols in, N.Y. State, 408.
- poisoning, studies, 479.

## Country—

- and town, service relations, Wis., 691.
- life and occupations in England, 594.
- Life Conference, proceedings, 893.
- (See also Rural.)

## Cover crops and fertilizers for orchards, 440.

## Cow—

- manure with straw or shavings, fertilizing value, R.I., 520.
- serum as colostrum substitute, 479.
- stall, construction, 590.

## Cowpea leaves, temperature, 425.

## Cowpeas—

- breeding experiments, P.R., 533.
- feeding value, Miss., 68.
- v. soy beans for pigs, 471.
- variety tests, V.I., 533.

## Cows—

- and milk production, treatise, 577.
- changes in composition, Mo., 868.
- feces, bacterial content, 475.
- feeding and management, 277; Ill., 73.
- feeding experiments, Can., 375; S.C., 73.
- feeding principles, Mo., 874.
- growth, Mo., 466.
- growth rate, 474, 578, 874.
- milk production. (See Milk production.)
- of Kleinhof-Tapiau, composition and milk production, 176.
- selection and value, 578.
- sterility of, 381.
- vitamin requirements, Minn., 175.
- (See also Calves, Cattle and Heifers.)

## Cranberries, insects affecting, Mass., 659.

## Cranberry—

- diseases, Mass., 656.
- industry in Canada, 38.
- industry, value of peat investigations to, 321.
- insect survey, 153.

## Cream—

- butterfat test, factors affecting, Ind., 178.
- in coffee, feathering, 852.
- neutralizing for butter making, N.Y. Cornell, 76.
- pasteurization, 878.
- production, best quality, Ind., 179.
- quality, relation to amino and ammonia nitrogen in, 476.
- soluble nitrogen compounds in, 805.
- test bottles, Babcock, testing accuracy, 714.

## Creamery inspection, N.J., 476.

## Creatin, preparation of creatinin from, 308.

## Creatin-creatinin metabolism, review, 162.

## Creatinin, preparation from creatin, 308.

## Creek, pH values, variations, 385.

*Creontiades pallidus*, studies, 52.

## Creosotes, low temperature, value, 485.

*Crepis capillaris*, inheritance of morphological characters in, 430.

## Cricket, western or Mormon, habits and control, 151.

*Cronartium—*

- ribicola* and *Peridermium strobili*, relation, 150.

(See also White pine blister rust.)

- strobilinum*, notes, 753.

## Crop—

- and business condition in Ninth Federal Reserve District, 192.

## atlas of India, 733.

## production as affected by potassium fertilizers, 818.

## production, forecasting, 692.

## reports, U.S.D.A., 92, 294, 491, 691, 894.

## tests, replication in relation to accuracy, 229.

## variation, studies, 234.

## yield as affected by carbon dioxide additions to soil, 625.

## yield, predicting, 13.

## Gropping experiments without phosphoric acid fertilization, 624.

## Crops—

- and markets, monthly supplement, U.S.D.A., 692, 894.

## cost of production in Scotland, 191.

## disease-resistant varieties, development, Minn., 143.

## effect on each other, 532.

## emergency, after rice failure, tests, 28.

## experiments in Travancore, 231.

## improvement by breeding, 828.

## improvement in Bengal, 828.

## scoring exhibits in, 195.

## water requirements, 733, 828.

(See also Field crops and specific crops.)

## Crossing-over—

- effect of affinity between genes, 730.
- in X-chromosome, effect of x-rays, 529.

## Crossover ratios, computing, 129.

## Crotalaria species, comparison, P.R., 533.

## Crown gall—

- organism, relation to host tissue, 42, 745.
- studies, 745.

Crown rust, dissemination by *Rhamnus*, U.S.D.A., 43.

## Crude fiber. (See Cellulose.)

*Cryptus retentor*, notes, U.S.D.A., 258.*Otenocephalus* spp., notes, 55.

## Cucumber—

- beetles, studies, N.Y.State, 555.
- black rot, notes, 651.
- downy mildew, control, S.C., 648.
- leaf spot, notes, 547.
- mosaic disease, notes, 547.

## Cucumbers—

- effect of limestone, 300.
- varieties, susceptibility to wilt, 748.
- yield as affected by irrigation, Mo., 15.

## Cucurbit mosaic, notes, 651.

## Cucurbitaceae, treatise, 727.

## Cultivation by electric tractor, 388.

## Culture media—

- adjustment of pH value, 411.
- desiccated, directions, 281.
- pH values v. titratable acidity in, 802.

## Culture solution, reaction, effect of plant, Calif., 821.

## Currant aphid, notes, N.Y.State, 555.

## Currants, spraying, 346.

## Custard apples, chalcid affecting, 58.

## Cutworm—

- pale western, distribution, 846.
- pale western, notes, 151.
- septicemia, notes, 846.

## Cutworms—

- control by poisoned bait, 53.
- studies, Mont., 155.

## Cyanamid—

- fertilizing value, U.S.D.A., 621.
- hydrolysis products, 9.
- in soil, behavior, U.S.D.A., 622.

## Cyanid. (See Hydrocyanic acid.)

## Cyclones, dynamics of, 414.

*Cylas formicarius*. (See Sweet potato weevil.)*Cylindrocopterus adspersus*, notes, 151.

## Cyperus—

- esculentus* tubers, analyses, 408.
- rotundus*, eradication, 238.

## Cystein, so-called auto-oxidation, 613.

## Cysticercus—

- spp., in frozen meat, 582.
- tenuicollis*, studies, 880.

## Cytospora—

- nicotianae*, notes, 248.
- sacchari*, notes, 244.

## Dahlias, culture, N.J., 39, 239.

## Dairies, regulations governing in England, 279.

## Dairy—

- barns, construction, U.S.D.A., 190.
- barns, design, 388.
- barns, regulations governing in England, 279.
- breeds, milk and fat yields, 676.
- cows. (See Cows.)
- farm survey, 592.
- farming in New York, N.Y.Cornell, 89.
- farming projects, handbook, 94.
- farming, treatise, 676.
- heifers, cost of raising, Can., 676.
- inspection, system, 876.
- laboratory manual, 195.
- products, cost, building and equipment factors, 97.
- products of California, statistics, 692.
- sires. (See Bulls and Sires.)
- stock, scoring exhibits in, 195.
- wastes, treatment and disposal, N.Y.Cornell, 487.

## Dairying—

- and agriculture, 891.
- extension program in, U.S.D.A., 695.
- in Canada, 676.
- in Czechoslovakia, 875.
- in Ireland, 676.
- in New Hampshire, 390.
- in New York State, statistics, 581.
- in New Zealand and Australia, 377.
- in Porto Rico, P.R., 676.
- in Switzerland, statistics, 581.
- publications on, U.S.D.A., 73.
- treatise, 780.
- (See also Creamery, Butter, Milk, etc.)

*Daldinia concentrica*, notes, 42.

## Damping-off disease, notes, 352.

## Danish experiment stations, history, 28.

*Danthonia pilosa*, analyses, 168.

## Date palm disease in Morocco, 249.

## Dates—

- culture, 39.
- culture experiments in Arizona, U.S.D.A., 138.

## Daturas affected by mosaic, alkaloidal content, 746.

*Davainea proglottina*, life cycle, 482.

## Death camas poisonous to livestock, 78.

## Deer mouse, inheritance of microscopic hair characters, 731.

## Deficiency diseases. (See Diet deficiency.)

## Dehydration. (See Drying.)

## Dehydrators, farm, 97.

## Delaware—

- Station, notes, 697.
- University, notes, 697.

## Delphacidae, North American, studies, 756.

## Delphiniums, treatise, 141.

## Dengue fever, method of spread, 156.

## Denitrification for sewage purification, 288.

*Deporaus tristis*, papers on, 256.

## Dermacentor—

- albipictus*, notes, Minn., 153.
- venustus*, paralysis due to, 762.



- Dermatophilus penetrans*, notes, 55.  
 Derris as a parasiticide, 755.  
*Desmorcerus palliatus*, biology, 661.  
 Destructive Insect and Pest Act of Canada, 151, 454.  
 Dew formation, 414.  
 Dewberries, culture, 543.  
 Dewberry orange rust, studies, 149.  
 Dextrins, synthetic, constitution, 505 .  
 Diabetes—  
   effect of fasting compared with replacement diet, 766.  
   insulin treatment in, 766.  
   (See also Insulin.)  
*Diabrotica 12-punctata*, notes, 747.  
*Diachasma fullawayi*, notes, 55.  
 Diamond-back moth, summary, 53.  
*Diaporthe sojae* n. sp., description, 840.  
*Diaprepes abbreviatus*, notes, V.I., 555.  
 Diarrhea, bacillary white, of chicks, 884; Ill., 285; Mass., 383.  
*Diaspis pentagona*, parasite of, 459.  
 Diastatic power, estimation, 196.  
*Diatraea* spp., life cycle and habits, 155.  
 Dibromoxyleneol sulphonephthalein, use as indicator, 311.  
 Dichlorohydroquinone for spot disease on rubber, 452.  
 Dicyanodiamidin, determination, 9.  
*Dicyphus* sp., notes, V.I., 555.  
 Diet—  
   accessory factors. (See Vitamins.)  
   deficiency disease, pathogenesis, 865.  
   (See also Beriberi, Pellagra, Rickets, etc.)  
   during pregnancy, effect on nutrition of offspring, 261.  
   effect on secondary anemia, 262.  
   high protein, effect on kidneys, 162.  
   kitchens at Peoria State Hospital, 360.  
   of children. (See Children.)  
   of infants. (See Infants.)  
   relation to tropical diseases, 865.  
   (See also Food and Nutrition.)  
 Dietary factor essential for reproduction, 261.  
 Diethylphthalate, test for, 507.  
 Digestion, effect of pH value of foods, 854.  
*Diospilus oleraceus*, notes, 57.  
 Diphtheria—  
   avian, epidemic, 284.  
   immunization, oral route for, 478.  
*Diplodia*—  
   *natalensis*, control, U.S.D.A., 149.  
   *natalensis*, utilization of citric acid by, 630.  
   *zeae* in seed corn, 548.  
   *zeae*, studies, Iowa, 145.  
*Diprion simile*, studies, U.S.D.A., 458.  
*Dirrhinus sarcophagae*, notes, 359.  
 Diseases—  
   deficiency. (See Diet deficiency disease.)  
   in Tropics, relation to food, 865.  
   of animals. (See Animal diseases and specific diseases.)  
   Diseases—Continued.  
     of plants. (See Plant diseases and specific host plants.)  
*Dissosteira longipennis*, life history, habits, and control, Colo., 52.  
 Ditch digging, machinery in, 885.  
 Ditches, drainage and irrigation. (See Drainage and Irrigation.)  
 Dodder—  
   combating, 238.  
   in Italy, identification, 439.  
   seeds, testing, 238.  
 Dogs—  
   age and chemical development, 569.  
   identification by nose prints, 269.  
 Domestic science. (See Home economics.)  
 Douglas fir—  
   and redwood, fire resistance, 40.  
   Chermes, life history, 556.  
   distribution and habits, 344.  
 Dourine—  
   pathological conditions, 883.  
   treatment with Bayer 205, 81.  
 Drainage—  
   and irrigation for Willamette Valley, 285.  
   assessments against roads and railroads, 586.  
   district assessments, U.S.D.A., 886.  
   ditching and reclamation, 885.  
   farm, correct methods of, 385.  
   highway, 586.  
   in Illinois, 885.  
   papers on, 99.  
   pipe outlets, hydraulic tests of flap valves, 587.  
   systems, farm, installing, 385.  
 Drains, spacing, relation to soil properties, 84.  
 Dried blood—  
   effect on nitrogen fixing power of soil, 119.  
   fertilizing value, 624.  
*Drosophila*—  
   duration of life in, 824.  
   types of chromosome groups, 528.  
*Drosophila melanogaster*—  
   reverse mutation in, 331.  
   sex ratios in, 530.  
 Drought, studies, 13.  
 Drug plants, history and folklore concerning, 140.  
 Drugs—  
   chemical nature, 880.  
   inspection, Me., 58.  
 Drying of fruits and vegetables, 97.  
 Ducks—  
   cost of rearing, Can., 473.  
   feeding experiments, Can., 777.  
   natural history, treatise, 355.  
   raising, feed costs, Can., 778.  
 Duff moisture conditions and forest fires, 544.  
 Dust explosion, lower limits of concentration for, 688.

## Dusting—

- machine, self-mixing, notes, 52.
- v. spraying, 446; Can., 643.
- v. spraying for celery blight, 651.
- v. spraying in Hawaii, 356.

(See also Spraying and specific crops.)

Dyes, spectral transmissive properties, 714.

Dynamometer, portable recording, description, 588.

*Dysdercus supersticiosus*, life history and habits, 755.

Dysentery, bacillary, immunization, oral route for, 478.

Earthenware pots, source of error in experiments, 617.

Earwig as horticultural menace, 153.

*Eccoptogaster rugulosus*, notes, 449.

*Echidnophaga gallinaceous*, notes, 55.

## Economics—

of the household, textbook, 797.

rural. (See Rural economics.)

Education, agricultural. (See Agricultural education.)

Educational forces, correlation, 895.

## Egg production—

- and body temperature, 872.
  - beef scrap v. skim milk for, Can., 373.
  - by hens and pullets, Can., 471.
  - changes in, Mass., 577.
  - costs, Can., 779; N.J., 872.
  - effect of pituitary feeding, 275.
  - effect of vitamin B on, Pa., 473.
  - feeding for, Ill., 373.
  - home-grown v. commercial feeds for, 273.
  - of dams and daughters, correlation coefficients, 275.
  - of pullets and hens, Can., 372.
  - records, lessons from, N.J., 72.
  - records, prediction, N.J., 779.
  - relation to stage of senescence, 577.
- (See also Hens, laying.)

## Egg—

- record, annual, correlation with sexual maturity, 577.
- weights, factors affecting, W.Va., 675.
- yolk, antirachitic value, 165, 166.

## Egg-laying—

- contest in Western Washington, West.Wash., 598.
- contests, N.J., 473.

## Eggplant—

- Cercospora* leaf spot, notes, 748.
- collar rot, notes, 244.
- leaf-miner, studies, 847.

## Eggplants—

- breeding experiments, P.R., 540.
- manuring experiments, R.I., 35.
- yield as affected by irrigation, Mo., 15.

## Eggs—

- fertility and hatchability, Can., 472.
- from early v. late hatched chicks, Can., 273.
- graded, culinary value, 161.
- hatchability, effect of time of year, Can., 373.

## Eggs—Continued.

- hatchability, relation to *Bacterium pullorum*, 685.
- hatching experiments, Can., 778.
- hatching from hens v. pullets, Can., 473.
- hatching percentages in different months, Can., 778.
- in cold storage, effect of ventilation, 873.
- incubation, Mo., 873.
- incubation, natural and artificial, U.S.D.A., 174.
- incubation, temperature experiments, Ind., 374.
- infertile market, value, Mo., 872.
- liquid, boric acid determination in, 805.
- loss in weight during incubation, Can., 472.
- loss of weight, effect of size, 374.
- loss of weight, physical basis, 577.
- lying in water, incubating, 873.
- marketing in Indiana, 873.
- preservation, Can., 472.
- preservation, use of water glass in, 615.
- winter production, effect on fertility and hatchability, Can., 471.

*Elaphidion villosus*, notes, 449.

Electrical cultivation, new system, 388.

## Electricity—

- application to household and farm, 388.
- for farms, conditions of supplying, 486.
- in German agriculture, 88.
- on the farm, bibliography, 287.
- on the farm, papers on, 98.
- use in commercial cooking, 58.

## Electroculture—

- in France, 131.
- in Great Britain, 131.

Electrolytes, effect on ammonia absorption, 722.

Electrons in chemistry, treatise, 608.

*Eleodes suturalis*, biology, 849.

Elk tick, notes, Minn., 153.

Elms, American, twig blight of, 656.

*Elodea canadensis* bud, cytological observations, 125.

*Emersonella lemae*, notes, 849.

Emmer, culture experiments, Can., 231.

*Empoasca mali*. (See Potato leafhopper.)

Endosperm development and F<sub>2</sub> sterility in wheat, Me., 27.

## Engineering—

- agricultural, courses, 100.
- agricultural, papers on, 100.
- agricultural, research, 100.
- education in land-grant colleges, 895.
- formulas, design of diagrams for, treatise, 586.
- research, notes, 96.
- sanitary, present status, 590.



- Engineering—Continued.  
     structures, structural members and connections, treatise, 286.
- Engines, internal-combustion—  
     effect of speed on mixture requirements, 188.  
     fuels for, 588.  
     spark advance in, 187.
- English hay, digestibility, Mass., 168.
- Enteritis of fowls, treatment, 82.
- Enterohepatitis, infectious. (*See* Black-head.)
- Entomological publications of U.S. Government, 554.
- Entomologist law of Colorado, 151.
- Entomology—  
     biological control in, 857.  
     in Porto Rico, status, 657.  
     manual, 151.  
     medical, textbook, 453.  
     relation to forestry, 844.  
     (*See also* Insects.)
- Enzymes, proteolytic, action on insulin, 767.
- Epiblema penkleriana*, notes, 554.
- Epidemiology, experimental methods in, 784.
- Epigae repens*, root system, relation to soil fungi, 428.
- Epilachna*—  
     *borealis*, life history and habits, Va., 759.  
     *corrupta*. (*See* Bean beetle, Mexican.)  
     *Epitrix parvula*. (*See* Tobacco flea-beetle.)  
     *Eragrostis leptostachya*, analyses, 168.
- Ergot, studies, 143.  
     (*See also* specific host plants.)
- Erysiphe—  
     *cichoriacearum*, forms, 347.  
     *cichoriacearum*, notes, 248.  
     *graminis*, notes, 548.  
     *horridula*, specialization in, 446.  
     *polygoni*, notes, Ohio, 145.
- Erythroneura* spp., studies, 755.
- Estate in Egypt in third century B. C., 891.
- Ethanol from fermentation of corn, 12.
- Ether extract of feces, notes, 804.
- Eucalyptus oil, value against chicken nematodes, Minn., 152.
- Eulia* spp., life history studies, Pa., 454.
- Eumerus strigatus*—  
     control, 452.  
     studies, 156.
- Euonymus scale, egg stage, notes, Conn. State, 50.
- Euproctis chrysorrhoea*. (*See* Brown-tail moth.)
- Eureka, analyses, Oreg., 7.
- Eutettix tenella*. (*See* Beet leafhopper.)
- Evaporation—  
     - from bare and cultivated soils, 117.  
     from soils, 812.
- Evergreens, cultivated, treatise, 240.
- Ewes, range, feeding experiments, 716.  
     (*See also* Sheep.)
- Excavation, engineering, treatise, 286.
- Exoascus deformans*, control, 451.
- Exorista flavirostris*, notes, 258.
- Experiment Station Record—  
     change in editorial management, 5.  
     evolution of, editorial, 3.
- Experiment stations—  
     in Denmark and Norway, work, 28.  
     maintaining volume of research, 405.  
     (*See also* Alabama, Arizona, etc.)
- Experimental data, statistical significance, 569.
- Explosive, new agricultural, Mich., 484.
- Explosives, use in agriculture, N.J., 791.
- Extension work. (*See* Agricultural extension.)
- Fabre, J. H., biography, 253.
- Fabrics, woven, treatise, 695.
- Fairs, score cards for, 195.
- Family budget for small income, 797.
- Fannia* sp., notes, 358.
- Farcy. (*See* Glanders.)
- Farm—  
     accounting, 290.  
     accounting, allocation of rent and interest in, 199.  
     accounting in rural schools, 195.  
     accounting manual, N.J., 492.  
     accounting studies, Minn., 191.  
     accounting, textbook, 898.  
     animals. (*See* Livestock and Animals.)  
     buildings, construction, 97.  
     buildings, ventilation systems in, 97, 689.  
     business, analysis, 199, 394.  
     credit. (*See* Agricultural credit.)  
     equipment, intra-company standardization, 485.  
     homes, equipment, 97.  
     homes, family living in, U.S.D.A., 595.  
     homes in Nebraska, 893.  
     homes, paper on, 895.  
     implement industry, intra-company standardization, 98.  
     implement industry, notes, 96.  
     implements and machinery, treatise, 189.  
     implements and tools, care, 388.  
     labor supply and business, 392.  
     (*See also* Agricultural labor.)  
     lease forms, Iowa, 91.  
     machinery. (*See* Agricultural machinery).  
     management data, analysis, 689.  
     management in Great Salt Lake Valley, Utah, 190.  
     management, papers on, 197.  
     management, statistical analysis, 390.  
     management, studies, Mont., 191.  
     management, treatise, 590.  
     mechanics for Utah high schools, 797.  
     model, in Panama, 700.  
     motor and implement courses, standardization, 100.  
     organization, Minn., 889.  
     ownership in Massachusetts, 690.

## Farm—Continued.

- power studies, 98.
- prices, future trend, 198.
- products. (*See* Agricultural products.)
- tenancy in Nebraska, Nebr., 290.
- (*See also* Land holdings, Land tenancy, and Land tenure.)
- tenants in Iowa, Iowa, 892.
- tenants in North Carolina, living conditions, 493.
- women, views on country life, 393.
- woodlands, treatise, 695.
- woodlots, improvement, Mich., 242.

## Farmers—

- organizing for economic and political action, 393.
- purchasing power of, 691.

## Farmers'—

- clubs in England, 696.
- income tax assessment in Great Britain, 192.
- net income, increasing, 591.

## Farming—

- dairy. (*See* Dairy farming.)
- in western Kansas, suggestions, 828.
- partnerships in Spain, 391.
- Russian, under the Soviet, 794.
- textbook, 94.
- (*See also* Agriculture.)

## Farms—

- in Brandenburg, returns, 890.
- in undeveloped regions, purchasing, U.S.D.A., 591.
- lighting systems for, 589.
- North American, factors affecting size, 89.
- on drained marsh land, Wis., 792.
- purchasing from farm earnings, 593.

## Fat—

- determination in buttermilk, 10.
- determination in food and soap, 614.
- effect on diabetes and insulin requirement, 767.
- excess, relation to iodine requirements and thyroid, 865.
- importance in animal feeding, 267.
- in blood in avitaminosis, 860.
- metabolism in avitaminosis, 860.

## Fats—

- acetyl values, determination, 11.
- and oils, unsaponified matter, 196.
- dry rendering, 112.
- effect on thyroid glands of pigeons, 668, 865.
- Kreis test, quantitative aspects, 713.
- rancid, compounds developed in, 609.
- relative values, 852.
- (*See also* Oils.)

Fat-soluble A. (*See* Vitamin A.)

## Fatty acids, volatile, production by propionic acid bacteria, 279.

## Feces, ether extract of, 804.

## Federal Farm Loan Act, amendments, 793.

Feeding experiments. (*See* Cows, Pigs, etc.)

## Feeding stuffs—

- chemistry of, 266.
- conservation, 865.
- diagnostic characteristics, Mich., 714.
- digestibility, Mass., 168.
- home grown, starch equivalent unit, estimating, 268.
- inspection and analyses, Conn.State, 169; Mass., 774; Me., 268; N.J., 367; Vt., 367.
- inspection and analyses—
  - in Michigan, 169.
  - in North Carolina, 169.
  - in West Virginia, 169.
  - in Wisconsin, 573.
- law, enforcement, Kans., 65.
- microscopic analysis, 468.
- quality of proteins in, 775.

## Feldspar, potassium content, 521.

## Fennel, culture and preparation of products, 140.

## Fermentation, alcoholic, treatise, 806.

## Fermentations, abnormal, in milk, Ohio, 580.

## Ferns, culture, 240.

## Ferns, sporangium in, cytological study, 223.

## Ferrous sulphate, effect on sulphate leachings, 523.

(*See also* Iron.)

## Fertilizer—

- distributors, 589.
- experiments at Pusa, 210.
- (*See also* special crops.)

## industry, directory, 220.

## inspection law of West Virginia, 124.

## law, Conn.State, 626; Mo., 626.

## plat experiments, N.Y.State, 421; Pa., 422.

## plats, permanent, at Coimbatore, 214.

requirements of soils. (*See* Soils.)

## treatment, effect on evaporation, 812.

## Fertilizers—

- analyses, 10.
- analytical methods, 412.
- chemical terms used with, 220.
- comparison, R.I., 520.
- concentrated, economics of, 322.
- consumption, cost, and use in Spain, 125.
- definitions and standards, 197.
- diffusion of, N.J., 216.
- effect on wheat stem rust, 549.
- for crops and soils, Del., 18.
- insoluble phosphoric acid in, 712.
- inspection and analyses, Conn.State, 626; Kans., 20; Ky., 324; Me., 626; Mo., 821; R.I., 626; S.C., 20; Vt., 324.
- inspection and analyses in Pennsylvania, 821.
- inspection and analyses in West Virginia, 124.
- location in respect to seed, effect, N.J., 213.



- Fertilizers—Continued.  
 mixed, value, 121.  
 nitrogenous. (*See* Nitrogenous fertilizers.)  
 phosphatic. (*See* Phosphates.)  
 potash determination in, 412.  
 selection and use, 322.  
 standard formulas and use, Tex., 220.
- Fertilizing elements in soil, mathematical analyses of effect, 214.
- Fescue, meadow—  
 breeding experiments, Can., 433.  
 duration in meadows, N.Y.Cornell, 231.  
 net blotch of, 651.
- Feterita, digestibility, Mass., 168.
- Fetus—  
 growing, effect on milk production, Ky., 873.  
 human, lineal growth, formulas, 868.
- Fiber—  
 crops, studies, 829.  
 crude. (*See* Cellulose.)
- Fibers—  
 cell-wall structure, 629.  
 from abaca, comparative study, 638.  
 Philippine, grading, baling, and inspection, 434.  
 properties and uses, 534.  
 textile, microscopic characteristics, 434.  
 (*See also* Hemp, etc.)
- Fibrin hydrolytic cleavage products, separation, 108.
- Field crops—  
 cost studies, Can., 533.  
 in South Africa, 333.  
 statistics, 532.  
 work in British Guiana, 134.  
 work in Burma, 231.  
 work in England, 134.  
 work in India, 28, 433.  
 work in Ireland, 231.  
 work in Madras, 433.  
 work in Montserrat, 28.  
 work in Mysore, 433.  
 work in Nigeria, 828.  
 work in Philippines, 733.  
 work in Scotland, 433.  
 work in Tanganyika, 433.  
 work in West Indies, 433.  
 (*See also* Crops, Forage crops, Root crops, etc.)
- Field experiments—  
 calculation of probable soil error in, 316.  
 interpretation, 827, 828.  
 probable error concept in, 229.  
 standardization, 733.  
 technique, 432.  
 with irrigated rice, technique, 832.
- Field plat yields, statistical study, N.Y. State, 432.
- Fig diseases, 751.
- Fig trees, effect of notching on yield, 38.
- Filberts, culture experiments, Minn., 138.
- Filtration, industrial, treatise, 612.
- Finger prints, hereditary factors for, 731.
- Fir, insects affecting, 153.
- Fires, forest. (*See* Forest fires.)
- Fireworms, control, Mass., 659.
- Fish—  
 effect of milk waste, N.Y.Cornell, 488.  
 meal, feeding value, 266, 870; Can., 470.  
 meal, vitamin content, Ohio, 573.  
 salted, "pink" in, 762.  
 sex differentiation in, 331.
- Fishery industries, treatise, 709.
- Flap gates, hydraulic tests, 587.
- Flat sours in canned foods, Mich., 459.
- Flax—  
 and kindred fibers, studies, 134.  
 culture and processing, 536.  
 culture experiments, Can., 231.  
 fiber content, estimating, 335.  
 genetic analysis and multiple allelomorphs, 25.  
 hybrids, studies, 228.  
 in different retting stages, 234.  
 pollen and degeneracy, 432.  
 properties and uses, 534.  
 research activities, 135.  
 retting, relation to stem anatomy, U.S.D.A., 335.  
 variety tests, U.S.D.A., 132.  
 water requirements, 828.  
 wilt organism, metabolism, Minn., 146.  
 wilt resistant varieties, Minn., 143.  
 wilt, varietal resistance, Minn., 144.  
 winter, culture, 639.
- Flaxseed quality, factors affecting, 436.
- Fleas—  
 of Panama, 55.  
 on wild animals in Montana, 359.
- Flies—  
 bacterium pathogenic for, 455.  
 development and longevity, relation to microorganisms, 560.  
 effect of food on longevity and reproduction, 456.  
 house. (*See* House fly.)  
 muscoid, *Herpetomonas muscae-domesticae* in, 560.  
 transmitters of *Habronema*, 455.  
 two-winged, revision, 848.
- Florida—  
 Station, notes, 96.  
 University, notes, 96.
- Flosses, properties and uses, 534.
- Flour—  
 analyses, Conn.State, 160.  
 beetle, confused, notes, 51.  
 grade, effect on H-ion concentration of dough, 10.  
 hemicellulose of, 310.  
 interim report, 690.  
 of Russian wheat, milling and baking tests, 338.  
 price variations, relation to wheat price, 691.  
 protecting from insect attack, Minn., 152.

## Flour—Continued.

- strength, effect of starch, 712.
- strength of New Zealand wheat, 438.
- strong and weak, physico-chemical studies, 502, 503, 504.
- (See also Bread.)

Flower coloration, optimum altitude for, 427.

## Flowers—

- acclimatization, Alaska, 539.
- for cutting and decoration, treatise, 39.
- of Yellowstone National Park, 645.
- perennial, for North Dakota, N.Dak., 837.
- variety tests, Can., 643.
- wild, culture, 240.
- (See also Plants, ornamental.)

Fodder crops. (See Forage crops.)

Fodders, succulent, and vitamins, 774.

## Food—

- allergy, cause of illness, 262.
- at Lincoln State School and Colony, 360.
- chemistry and preparation, textbook, 898.
- in the home, care, U.S.D.A., 360.
- inspection, Me., 58.
- materials, oxidation to avoid loss of metals, 613.
- poisoning outbreak due to egg salad, 64.
- preparation in Chicago State Hospital, 360.
- preservation and botulism, treatise, 167.
- products, impurities in, identification, 805.
- selection, economics of, 262.
- supply of Austria, 895.
- tests, biological, 59, 462, 857.
- values, U.S.D.A., 762.
- (See also Diet.)

## Foods—

- analysis, 266.
- canned. (See Canned food.)
- diabetic and special, analyses, Conn. State, 160.
- drying. (See Drying.)
- fat determination in, 614.
- manufacture, 97.
- metals from cooking utensils in, 763.
- of France and colonies, 561.
- planning and preparation, textbook, 298.
- South African, antiscorbutic value, 64.
- stability of vitamins in, Minn., 163.
- vitamin values, table, U.S.D.A., 762.
- (See also specific foods.)

## Foot-and-mouth disease—

- immunity, 683, 684.
- immunization, abscesses from, 881.
- in Great Britain, 182, 882.
- notes, 582.
- plurality, 881.
- relation to bird migrations, 380, 786.
- summary, 380, 683.

## Forage crops—

- chemical study, Oreg., 7.
- feeding value, Ill., 673.
- seeding experiments, Can., 533.
- varieties for seed in Poland, 439.

Forage poisoning. (See Livestock poisoning, Plants poisonous, and specific plants.)

## Forest—

- administration. (See Forestry.)
- entomology in Lake States, 845.
- fire control, organization for, 240.
- fire prevention handbook, U.S.D.A., 141.
- fires and weather, 807.
- fires, importance of duff moisture content in, 544.
- fires in Connecticut, 544.
- fires, relation to relative humidity, U.S.D.A., 743.
- insect control, value of slash burning, Minn., 152.
- insects of Australia, treatise, 256.
- insects, treatise, 555.
- line, factors governing, 242.
- mensuration, textbook, 647.
- planting in northern California, 645.
- Products Laboratory, demonstration courses, U.S.D.A., 41.
- products research in United States, 141.
- reproduction with fire protection in Adirondacks, 646.
- resources of central Europe, 647.
- resources of New Zealand, 545.
- resources of the world, treatise, 141.
- Service, Dominion, work, 141.
- situation in United States, 743.
- soils, fertilization, 621.
- soils of Sweden, aeration, 318.
- species, methods of thinning, Mich., 242.
- survey of Moose River Lower Basin, 39.
- trees. (See Trees.)

Forestation, minimum requirements for, 646.

## Forestry—

- biotic factor in, 837.
- education and research, 443.
- entomology as aid, 844.
- experiments, S.C., 646.
- for profit, treatise, 242.
- in Canada, 344.
- in Federated Malay States, 40.
- in Finland, 838.
- in Great Britain, 544.
- in India, 40, 141, 242, 344, 345, 545, 647.
- in Japan, 242.
- in Maryland, 838.
- in New South Wales, 545.
- in New Zealand, 545.
- in Oregon, 647.
- in Philippines, 344.
- in South Australia, 545.



## Forestry—Continued.

- in Sweden, 743.
- in the Andamans, 39.
- relation to soils, Mich., 419.
- talks on, 240.

## Forests—

- and forestry, U.S.D.A., 240.
- Appalachian, scientific research, 240.
- national, of southern Appalachians, U.S.D.A., 39.
- of California, 240.
- of Canada, 344.
- of Michigan, 743.
- of Montana and Idaho, 240.
- of Quebec, notes, 647.
- revenues from, in Great Britain, 544.
- second growth hardwood, in Michigan, Mich., 241.
- Sierra, results of cutting in, U.S.D.A., 241.
- softwood, protecting, 837.

## Formaldehyde—

- detection, 803.
- effect on plumule development, Calif., 44.
- in living plants, 525.
- solution for smut control, 347.
- treatment of potatoes, maintaining standard concentration, 654.

## Formic acid—

- effect on egg production, 576.
- formation from cane sugar, 805.

*Formica* spp., pupae of as poultry feed, 576.

## Fowl—

- cholera vaccine, stability, 282.
- typhoid group, organisms, 185.

## Fowls—

- autopsies, observations on, 82.
- blood pressure and pulse, 82.
- gonads of, histological studies, 530.
- inheritance of color in, 227.
- sex reversal in, 530.
- (*See also* Chickens, Hens, Poultry, etc.)

## Foxtail bacterial disease, notes, 349.

## Fruit fly on oats, effect of early sowing, 55.

## Frost—

- data for cotton planting, U.S.D.A., 132.
- predicting, 208.
- protection by smoke, U.S.D.A., 115.

## Fructose, determination in presence of other sugars, 614.

## Fruit—

- breeding, Can., 339; Minn., 140.
- breeding, experimental accuracy in, 36.
- breeding, sterility studies, Minn., 130.
- bud formation in small fruits, 37.
- culture, textbook, 140.
- diseases, Minn., 148.
- fly larvae in cold storage, 359.
- fly, Mediterranean, in Hawaii, studies, 54.

## Fruit—Continued.

- fly, Mediterranean, menace to America, 259.
- fly, parasites of, 255.
- industry in New York State, 540.
- planting, value, West.Wash., 195.
- tree chlorosis, effect on composition of fruits, 248.
- tree leaf roller, control, 844.
- trees, dormancy in, Minn., 125.
- trees, effect of climatic conditions, U.S.D.A., 114.
- trees, insects affecting, 51, 153.
- trees, nutritive condition measured by catalase activity, 36.
- wraps, oiled, for apple scald, 750.

## Fruits—

- acclimatization, Alaska, 539.
- citrus. (*See* Citrus fruits.)
- distribution and prices in Great Britain, 293.
- in West Virginia, Kentucky, and Tennessee, U.S.D.A., 644.
- insects affecting, 153.
- picking, handling, and exhibiting, Mo., 238.
- pollination by bees and insects, 561.
- scoring exhibits in, 195.
- small, fall work with, West.Wash., 195.
- small, fruit bud formation, 37.
- small, variety tests, Can., 440.
- stone, bacterial gummosis of, 750.
- stone, Cladosporium cross-inoculations, 656.
- stone, diseases in British Columbia, 249.
- stone, spraying for brown rot, 552.
- variety tests, Can., 643.
- (*See also* Orchards, Apples, Peaches, etc.)

## Fuel, effect of compression on detonation, 188.

## Fungi—

- causing damping-off of coniferous seedlings, Minn., 49.
- citric acid as source of carbon for, 630.
- in soils, activities, 620.
- of Hawaii, 727.
- on roots of *Epigaea*, 428.
- research on, 142.
- volutin in, 428.
- wood-destroying, effect of heat, 754.

## Fungicidal dusts for bunt control, Calif., 43.

## Fungicides, summary, 255.

(*See also* Sprays and specific forms.)

## Fungus—

- gnats, notes, 255.
- spores, longevity, 630.
- Fur-bearing animals, laws, U.S.D.A., 252.
- Furfural manufacture from corncoobs, 505, 806.

## Furnace—

- heating, treatise, 589.
- warm-air, heat emission from, 589.

- Fusarium* blights of potatoes in India, 247.  
*Fusarium*—  
*cubense*, notes, 550.  
*culmorum leticius*, notes, 648.  
*gemmiperda*, notes, 842.  
*lini*, metabolism, Minn., 146.  
*martii pisi* n. var., notes, 839.  
*moniliforme*, notes, 546.  
*negundi* n. sp. description, 843.  
*oxyssporum*, notes, 243, 753.  
 sp., notes, Ohio, 145.  
 spp., cultural characteristics, 347.  
 spp., notes, 147, 243.  
 spp. on sweet potato, 749.  
 spp. on wheat and corn, 648.  
*theobromae*, notes, 42.  
*vasinfectum*, notes, 748.  
*Fusicladium dendriticum*. (See Apple scab.)  
*Galeatus peckhami*, life history, 453.  
 Game—  
   birds and wild fowl of British Islands, 355.  
   laws for 1923-24, U.S.D.A., 150.  
   protection, directory of officials for, U.S.D.A., 355.  
 Garbage, feeding value, Miss., 69; Wyo., 371.  
 Garden crops. (See Vegetables and specific crops.)  
 Gardening, treatise, 139.  
   (See also Vegetable gardening.)  
 Gardens, old country, of Switzerland, treatise, 239.  
 Gas engines. (See Engines, internal-combustion.)  
 Gaseous exchange in soils, mechanism, 719.  
 Gases—  
   for coloring citrus fruits, tests, P.R., 540.  
   poisonous, effect on plants, 428.  
 Gear wheels, treatise, 687.  
 Gelatin—  
   ash, arsenic, copper, and zinc in, 712.  
   liquefaction by bacteria, 526.  
   quality in, 180.  
*Gelechia*—  
*gossypiella*. (See Cotton bollworm, pink.)  
*trialbamaculella*, control, Mass., 659.  
 Genes, arrangement, linear theory of, 129, 730.  
 Genetic terms, discussion, 729.  
 Genetics—  
   and pathology, relation, 328.  
   principles, 527.  
   section, establishment in Experiment Station Record, 6.  
   theory, and problem of embryonic development, 527.  
   (See also Heredity.)  
 Geobotany, research methods in, 21.  
 Geotropism—  
   and mobile starch, 127.  
   discussion, 225.  
*Gibberella saubinetii*, relation to H-ion concentration, 44.  
*Gillettea cooleyi*, life history, 556.  
 Gipsy moth—  
   caterpillars, effect of inanition, 452.  
   control, Conn.State, 50.  
   control in New Jersey, 257.  
   intersexuality in, 226, 430.  
   menace in New York State, 155.  
 Girls' clubs, 298.  
 Gladiolus *Fusarium* rot, notes, 753.  
 Glanders—  
   human, serum therapy, 480.  
   notes, 582.  
   occurrence in Great Britain, 182.  
 Glands of internal secretion in polyneuritis, 265.  
 Gliadin, hydrolysis products, 8.  
 Globulin of wheat bran, analyses, 711.  
 Glucokinin, new hormone in plant tissue, 108, 765.  
 Glucose—  
   determination in presence of other sugars, 614.  
   effect on biochemical activities of *Bacillus botulinus*, 785.  
   effect on blood sugar content, 164.  
   reactions in animal body, 361.  
   utilization by *Aspergillus niger*, 125.  
 Glutathione—  
   constitution, 308.  
   properties, 461.  
 Gluten feed, digestibility, Mass., 168.  
 Glutenin—  
   effect on hydration capacity of flour, 504.  
   viscosity and loaf volume of flour, 504.  
 Glutens, imbibitional properties, 502.  
*Glycobius speciosus*, notes, Conn.State, 50.  
 Glycogen—  
   and avitaminosis, 163.  
   in tissues, effect of insulin, 260.  
 Glycolysis—  
   and insulin, 461.  
   in diabetic and normal blood, 569.  
 Goats—  
   body development, 574.  
   indirect calorimetry with, 266.  
   physiology of lactation in, 266.  
*Goes tessellatus*, studies, 662.  
 Goiter—  
   genesis, relation to fats, 668, 865.  
   prevention in lambs, Can., 371.  
*Gonizus claripennis*, biology, 561.  
*Gonoderma fulvellum*, notes, 42.  
 Gooseberries, breeding experiments, Can., 339.  
 Gooseberry mildew, control, 353.  
 Gopher control, 454.  
 Gophers, pocket, control, Minn., 153.  
 Gossypol—  
   effect on digestion of cottonseed globulin, 360.



## Gossypol—Continued.

- in cotton seed, variation and relation to oil in, 111.
- physiological effect, 680.

## Grafting—

- bridge, instructions, U.S.D.A., 643.
- new method, 543.
- waxes, comparison, Can., 36.

## Grain—

- aphid, control, Mo., 51.
- culture on corn land and fallow, Mont., 134.
- Exchange of Winnipeg, report, 891.
- Futures Act, 1922, U.S.D.A., 293..
- sacks, sewing, Calif., 190.
- seeding, measuring delivery rate with drill, 230.
- trade, Canadian, yearbook, 693.
- trade, internal, of United States, 690.
- varieties, West.Wash., 134.
- variety tests, Pa., 432.
- whole v. crushed, for pigs, Can., 370.
- (*See also Cereals and Oats, Rye, Wheat, etc.*)

## Granary weevil, transmission from infested wheat to macaroni, Minn., 152.

## Grape—

- insects, notes, N.Y.State, 555.
- juice, methyl anthranilate in, 205.
- leafhoppers, studies, 755.
- mildew, spore germination in, 249.
- Peronospora, control, 149.
- pigments, studies, N.Y.State, 410.
- pyralid, parasites of, 561.
- root knot nematode, control, 451.

## Grapefruit—

- disease, notes, P.R., 547.
- from Isle of Pines, diseases, 752.
- Phomopsis on Isle of Pines, 752.
- vitamin A in, 59.

## Grapes—

- as affected by potassium, 644.
- breeding, 238, 299.
- breeding, inheritance of anatomical characters N.C., 131.
- culture, Mo., 836; S.C., 642; West. Wash., 598.
- culture experiments in Arizona, U.S.D.A., 138.
- fertilizer experiments, N.Y.State, 539.
- insects affecting, 659.
- nutritional requirements, seasonal changes, 742.
- pruning experiments, N.Y.State, 539.
- pruning studies, 300.
- pruning systems, Can., 339.
- seed chalcid attacking, 851.

## Grass—

- and bone meal, efficiency in calcium equilibrium 678.
- loss in preserving, 866.
- mixtures, experiments in Finland, 533.
- seed, methods of covering, 34.
- take-all disease, 549.
- uptake of nutrients and storage, 333.

## Grasses—

- analyses, Oreg., 7.
- as silage crop, Alaska, 532.
- Australian, nutritive value, 168.
- culture experiments, S.C., 637.
- daylight germination of seeds, 34.
- from South America, new species, 735.
- green, efficiency in calcium equilibrium, 678.
- native, of India, comparisons, 28.
- pasture, useful, 434.
- seeding tests, N.Y.Cornell, 230.
- Septoria diseases of, 648.
- take-all disease, 746.
- varieties, characteristics, 237.
- water requirements, 828.
- (*See also Meadows, Pastures, and specific kinds.*)

## Grasshopper—

- campaign, 153.
- campaign, financing, Colo., 52.

## Grasshoppers—

- control in Alberta, 154.
- notes, 151.
- (*See also Locusts.*)

## Grasslands, fertilizer experiments, 122.

- (*See also Grasses, Meadows, and Pastures.*)

Gravel for roads. (*See Road materials.*)

## Gravels, Nebraska pit-run, experiments, 586.

## Greasewood as a poisonous plant, U.S.D.A., 77.

## Great Plains, climate of, 207.

## Grebes, North American, food and economic status, U.S.D.A., 754.

## Greeks in Egypt in third century B. C., 891.

## Greenhouses—

- and forcing beds, construction, 834.
- insect pests of, control, 255.

## Grit, amount present in gizzards of hens, N.C., 274.

## Growth—

- and senescence, chemical basis, treatise, 569.
- response to radiation, 364.

Growth-promoting accessory. (*See Vitamin.*)

## Guanol as source of carbon dioxid, 626.

## Gum levan formation from sucrose, 410.

*Gypsonoma neglectana*, notes, 554.

## Gypsum production in United States, 727.

*Habrobracon juglandis*, life history notes, 663.

## Habronema, relation to flies in Queensland, 455.

*Habronema* spp., notes, 359.

## Hair, mammalian, preparing sections, 467.

## Hampton Normal and Agricultural Institute, history and organization, 194.

*Haplophthalmus danicus*, notes, 255.

## Hardpan in Apulian soils, origin, 14.

## Hardwood, insects affecting, 153.

- Harmolita* spp., notes, 51.  
 Hatch Act, editorial, 2.  
 Hatch farm, bequest for agricultural experimentation, 1.  
 Hay—  
   and pasture mixtures, comparison, Can., 433.  
   cost of production, Can., 592.  
   cost studies, Can., 432.  
   ensiling, Italian method, 468.  
   for wintering lambs, 574.  
   mixtures, seeding experiments, Can., 533.  
   production, factors affecting, 534.  
   (See also Meadows, Grass, and Alfalfa, Clover, Timothy, etc.)  
 Health—  
   indexes, use of weight-height-age tables, 853.  
   problems, program for study, 298.  
   supervision, plan for, 94.  
 Heart nuts, culture experiments, Minn., 138.  
 Heat—  
   effect on microbiological activities in soil, 620.  
   effect on properties of milk, Pa., 411.  
   emission from warm-air furnace, 589.  
   losses through walls and roofs, 389.  
   moist and dry, action on vitamin B, 858.  
   resistance in embryo of sunflower, 325.  
   transmission through walls, measuring, 589.  
   (See also Temperature.)  
 Heating, warm-air, merits, 97.  
 Heifers—  
   cost of raising, Can., 676.  
   winter rations for, Mo., 875.  
   (See also Cows.)  
 Helianthus grafts, studies, 224.  
 Heliothis—  
   *obsoleta*, (See Cotton bollworm.)  
   *virescens*, notes, V.I., 555.  
 Helix pisana—  
   as citrus pest, 657.  
   poison bait for, 553.  
 Helminthosporium—  
   *avenae*, notes, 548.  
   *heveae* in Sumatra, 754.  
   *oryzae* on rice, 246, 654.  
   *sativum* on wheat, 649.  
   *sativum*, studies, Minn., 144.  
   sp., notes, 649.  
   sp. on Kentucky blue grass, 650.  
   sp., undescribed, on fescue, 651.  
 Helopeltis theivora, control, 556.  
 Helophorus rugosus, notes, 57.  
 Hematology, treatise, 680.  
 Hemerocampa leucostigma. (See Tussock moth, white-marked.)  
 Hemicelluloses, studies, 310.  
 Hemichtonaspis minor strachani, notes, V.I., 555.  
 Hemiptera—  
   of Connecticut, 755.  
   of Cranberry Lake region, 453.  
 Hemiptera-Heteroptera of Nova Scotia, 844.  
 Hemlock, distribution and habits, 344.  
 Hemorrhagic septicemia. (See Septicemia.)  
 Hemp—  
   fiber content, estimating, 335.  
   fibers, identification in paper pulp, 509.  
   height of, 31.  
   manila. (See Abaca.)  
   Mauritius, fiber elements, 434.  
   Mauritius, inferiority, 436.  
 Hens—  
   body temperature and egg production, 872.  
   endogenous metabolism, 576.  
   laying, animal protein for, Mont., 871.  
   laying, confinement v. range, Can., 471, 779.  
   laying, feeding, Can., 778.  
   (See also Egg production.)  
   time of selling, Can., 272.  
   v. pullets as breeders, 273.  
   v. pullets, hatching results, Can., 778.  
   weight, relation to production, Can., 779.  
 Heredity—  
   acquired, 332.  
   and twins, 731.  
   in barley hybrids, 228.  
   in cotton, 531.  
   in phlox, Pa., 430.  
   in poultry, review, 128.  
   in soy beans, 632.  
   in swine, 128.  
   mode of and cytological explanation, 226.  
   of acquired antibodies, 783.  
   of acquired characters, 130, 431.  
   of anatomical stem characters in grapes, N.C., 131.  
   of blotch leaf in corn, N.Y. Cornell, 24.  
   of boll loculi number in cotton, 632.  
   of branched ears in corn, 528.  
   of color. (See Color inheritance.)  
   of dead leaf margins in corn, 529.  
   of dwarfing in corn, 129.  
   of egg color in silkworm, 531.  
   of embryo color in peas, abnormality in, 331.  
   of germless seeds, 528.  
   of glume length in a wheat cross, 27.  
   of kernel characters in wheat, 732.  
   of microscopic hair characters in deer mouse, 731.  
   of morphological characters in Crepis, 430.  
   of mutation, 729.  
   of naked character in oats, 227.  
   of rust resistance in wheat crosses, 634, 635.  
   of semisterility in rice, 330.  
   of shortness of thumbs, 227.  
   of size and conformation in sheep, N.H., 26.  
   of size in animals, 823.



## Heredity—Continued.

- of spangling in poultry, 528.
- of spotting in Holstein cattle, 631.
- of variegation in *Chlorophytum*, 23.
- of webbed toes in man, 530.
- of white markings in cattle, 731.
- theories basing studies on *Oenothera*, 527.
- units in, 729.

*Herpetomonas muscae-domesticae*—

- in muscoid flies, transmission experiments, 560.
- morphology and life history, 358.

## Hessian fly—

- delayed emergence, 559.
- in Kansas, Kans., 54.
- notes, 51.
- parasite, development, 158.
- parasite, studies, 58.

*Heterakis*—

- spp., control, Minn., 152.
- vesicularis*, control, 82.

*Heterodera radiculicola*—

- control, 251, 451; Fla., 652; Va. Truck, 843.
- notes, 42.

*Hevea brasiliensis*. (See Rubber.)*Hexagona discopoda*, notes, 42.

## Hides and skins, 293.

## Highway—

- research at Pittsburg, Calif., 484.
- research in Illinois, 790.
- research projects, apparatus used in, 386.
- research, relation to road construction, 789.
- transportation, treatise, 88.

## Highways. (See Roads.)

## Hog cholera—

- bacilli, mutation in, 788.
- control, 883.
- immunity, studies, Minn., 182.
- notes, 582.
- occurrence in Great Britain, 182.
- studies, 382.
- transmission by fowls, 382.
- vaccination, "cholera breaks" after, 481.

## Hogs. (See Pigs.)

## Hollyhock rust, studies, 150, 250.

## Home—

- demonstration work, status and results, U.S.D.A., 95.
- economics—
  - bibliography, 695.
  - course of study in Vermont, 496.
  - courses for teacher training, 395.
  - education in negro teacher-training institutions, 495.
  - education, International Congress, 796.
  - handbook, Illinois, 94.
  - in negro schools, home making courses in, 597.
  - instruction, home project work in, 395.

## Home—Continued.

## economics—continued.

- instruction, practice house v. home, 95.
- instruction, standards of accomplishment, 395.
- objectives in elementary schools, 796.
- papers on, 896.
- practice teaching in, 94.
- teachers, State schools for in Norway, 94.
- vocational education in, 796.
- work in Spain, 599.
- grounds, beautifying, Colo., 645.
- makers, training school for, 297.
- making in part-time schools of New York, 695.

## Homoptera on Cranberry Lake, 453.

## Honey—

- American, color and composition, 196.
- locust beans, chemical and structural study, U.S.D.A., 501.

## Honeybees. (See Bees.)

## Hookworms—

- control, 380, 684.
- pharynx and alimentary canal, 160.

## Horn fly, effect of food on longevity and reproduction, 456.

## Hornbean in Britain, 838.

## Hornworm septicemia, 845.

## Horse—

- beans, analyses, Oreg., 7.
- labor, cost, Can., 272.

## Horse-radish bacterial root rot, 748.

## Horses—

- breeding in Germany, effect of war, 575.
- development in Yugoslavia, 372.
- draft, feeding experiments, 575.
- dynamometer for testing, 288.
- feeding experiments, 272.
- history, development, and uses, 575.
- immunization against anthrax, 79.
- judging, 174.
- management, 775.
- production, Kans., 71.
- pulling power, paper on, 97.
- soy beans for, Ill., 675.

## Horticultural development in past 75 years, 299.

## House—

- flies, control, 255.
- flies, effect of food on longevity and reproduction, 456.
- floors, unusual damage by wasps, 664.

## Houses, heat losses through walls and roofs, 389.

## Humidity—

- effect on testing cotton materials, 234.
- relative, and forest fires, U.S.D.A., 743.

## Humus—

- accumulation in soil, limits, 815.
- carbon determination in, 202.
- determination in soils, 202.

## Humus—Continued.

effect on nitrogen fixation, 120.  
soils, decomposition of neutral salts  
by, 514.

Hybrids, subspecific, in deer mice, 822.

Hydrangea flowers, color regulation, 300.

Hydraulic ram, design and installation,  
789.

## Hydrocyanic acid—

gas fumigation, history, 657.

in plants, synthesis, 224.

v. potassium cyanid, 151.

Hydrogen-ion concentration, relation to  
wheat scab, 44.

Hydrology, ground-water, outline, 83.

Hydrometric data in Washington, summary,  
789.

Hydrophobia. (See Rabies.)

Hygiene, home and community, textbook,  
797.

Hygroscopicity, effect of soil reaction, 618.

*Hylocurus parkinsoniae* n. sp., description,  
453.

*Hylocurus*, revisional notes, 453.

Hyperglycemia, cause, 164.

*Hyphantria cunea*. (See Webworm, fall.)

*Hypoderma lineatum*, migration, 880.

*Hypoderma* spp. in Switzerland, 560.

## Ice cream—

acidity, discussion, 378.

air cells in, 782.

analyses, Conn.State, 160.

bacterial content, 180.

bacterial content, effect of manufactur-  
ing operations, Mich., 580.

bacteriology, Mich., 496.

chocolate, greenish black color in, 477.

composition and manufacture, 281.

improvement by homogenization, 782.

industry, acidity problem in, 281.

ingredients, Nebr., 580.

manufacture, Pa., 477.

mix, effect of acidity, 580, 679.

mix, formulas and standardizing, 783.

quality, factors affecting, 782.

quality, relation to composition of  
mix, 477.

sampling, 878.

sandiness in, studies, Minn., 179.

smoothness, relation to air cells, N.Y.  
State, 581.

Iceland moss as famine food, 561.

*Ichneumonidae* in Pusa collection, list, 58.

Idaho University, notes, 697.

Iletin, lethal action, resistance of pigeons  
to, 467.

Illinois University, notes, 396, 899.

Imhoff tanks, fauna of, 289.

Imhoff tanks, proper placing of slots in,  
389.

## Immunity—

duration, 681.

local, studies, 78.

passive, duration, 783.

## Immunization—

against foot-and-mouth disease, 683,  
684.

by reinoculation after long interval,  
282.

development of protein after prophylactic  
inoculation, 680.

with avirulent living organisms, 282.

(See also Anthrax; Hog cholera; Tuberculosis, etc.)

Imperial College of Tropical Agriculture,  
notes, 499.

Incinerator, beehive, construction and op-  
eration, 89.

## Income tax—

applying to agricultural property, 192.

assessment of farmers in Great  
Britain, 192.

## Incubation—

methods, 273.

systems, comparison, Can., 778.

temperature experiments, Ind., 374.

## Incubators—

different makes, Can., 372, 472.

instructions for running, N.J., 873.

Indian meal moth, parasite of, 663.

"Indian summer," weather type of eastern  
United States, 315.

Industrial development of the South, 399.

Infant foods, analyses, Conn.State, 160.

## Infants—

feeding for preventing nutritional dis-  
turbances, 59.

feeding, lactic acid milk for, 856.

(See also Children.)

Infection and resistance, treatise, 581.

Infections, genital, rôle of male in, 783.

Inheritance. (See Heredity.)

## Insect—

anatomy, treatise, 253.

life, 496.

metamorphosis, researches on, 356.

pests, control, 356.

## Insecticides—

and natural control of insects, 454.

summary, 255.

tests, 258.

(See also Sprays and specific forms.)

## Insects—

affecting livestock, 453.

and arthropods, 554.

and worms, parasitic relations, 51.

beneficial, predacious forms, Ohio, 554.

cage for rearing on plants, 151.

control by dusting, N.Y.State, 555.

control in United States, 255.

control, treatise, 253.

economic, of Sweden, treatise, 153.

effect of inanition, 452.

forest. (See Forest insects.)

household, Calif., 845.

in Brazil, systematic catalogue, 51.

in freshly cut logs, Minn., 152.

in logs, ecology, 755.



## Insects—Continued.

- injurious, and parasites, 554.
- injurious in Burma, 51, 153.
- injurious in Canada, 454.
- injurious in Colorado, 151.
- injurious in England and Wales, 255.
- injurious in England Wales, 255.
- injurious in Georgia, 844.
- injurious in New Brunswick, 844.
- injurious in Scotland, 153.
- injurious in Southern Rhodesia, 153.
- injurious in Uganda, 55.
- injurious to crops. (*See special crops.*)
- instincts and habits, treatise, 151.
- longevity, 255.
- national collection of Canada, 454.
- of Connecticut, guide, 755.
- of greenhouses, control, 255.
- parasitic and disease-carrying, Minn., 152.
- pH values in alimentary tract, 452.
- refrigerator for shipping, 657.
- scale. (*See Scale insects.*)
- social life among, treatise, 253.
- starvation, effect on offspring, 732.
- transmission on bud and grafting wood, 453.

## Insulin—

- absorption from stomach, 767.
- action, mechanism, 863.
- action of proteolytic enzymes on, 767.
- and glycolysis, 461.
- cure, value of levulose and vitamin B in, 864.
- effect of ammonium hydroxide, 802.
- effect on glycogen in tissues, 260.
- in tissues other than pancreas, 260.
- physiology, 260.
- possible sources, 767.
- preparation, 712.
- purification, 611.
- requirement, effect of carbohydrate and protein in diet, 766.
- solubility, 311.
- studies, 864.
- summary, 611.
- treatment, papers on, 766.

## Insurance—

- compulsory accident, in Italy, 292.
- cooperative farm, 593.

## International—

- Association of Dairy and Milk Inspectors, report, 875.
- critical tables of numerical data, 885.
- Seed Testing Conference, report, 237.

## Intersexuality, studies, 130, 226, 430, 530.

## Inulin—

- analyses, Conn.State, 160.
- constitution, 505.

## Iodin—

- metabolism, 865.
- occurrence in nature, 608.

## Iowa—

- College, notes, 396, 497, 899.
- Engineering Society, proceedings, 586.
- Station, notes, 497.

## Ipidae, new species from Maine, 453.

## Ips—

- cembrae* as permanent pest, 255.
- typographus*, control, 255.

## Iris—

- cell structure, studies, 427.
- soft rot, studies, 354.

## Iron—

- availability to plants, factors affecting, 212.
- deficiency in diet of pigs, effect, 172.
- in blood and spleen of horses with infectious anemia, 684.
- in plants, studies, 128.
- (*See also Ferrous.*)

## Irrigation—

- corrugation method, U.S.D.A., 84.
- cost of pumping for, 483.
- development of West under, 385.
- devices, homemade, 385.
- districts, operation, U.S.D.A., 186.
- experiments, Mo., 15.
- (*See also special crops.*)
- important advances, 99.
- in Ajmer-Merwara district, 286.
- in California, list of references, Calif., 285.
- in India, 484, 686.
- of Egyptian soils by flooding, 512.
- project, Rio Grande, 84.
- requirements of California lands, 84.
- structures, farm, construction, 385.
- water, economical use, 384.
- with Nile water, effect, 316.

## Japanese beetle, control, N.J., 56.

*Jatropha stimulosa* seeds, analyses, 610.

## Jelly—

- making, 160.
- strength tester, plunger type, 12.

## Jewish Agricultural Society, report, 894.

## Jujubes, culture experiments in Arizona, U.S.D.A., 138.

## Jute—

- diseases in relation to manures, 42.
- improvement in Bengal, 828.

## Kale—

- and cabbage hybrids, 633.
- as affected by sulphur, Oreg., 724.
- fertilizer experiments, West.Wash., 520.

## Kansas—

- College, notes, 299, 396, 697.
- State institutions of higher learning, survey, 194.
- Station, notes, 697.

## Kapok, properties and uses, 534.

## Kelp—

- industry, history, 123.
- potash from, U.S.D.A., 424.

## Kentucky—

- Station, notes, 96.
- University, notes, 96.

## Keratomalacia, fatal in an infant, 772.

## Kidney worm of hogs in New South Wales, 586.

## Kidneys—

- effect of high protein diet, 162.
- excretion of insulin by, 864.
- insulin-like substance in, 864.

## Klein disease, treatment, 82.

## Koufri, effect on nitrification in soil, 721.

## Lactalbumin, soluble, from whey, 280.

## Lactose—

- crystallization in sandy ice cream, Minn., 179.
- extraction from whey, 280.
- in milk, determination, 614.
- in milk, polariscopic determination, 714.
- propionic acid fermentation, 109, 205.

## Ladybird, South African, introduction into California, 661.

*Lagochirus araneiformis*, notes, V.I., 555.

## Lake States Forest Experiment Station, field, 240.

## Lambs—

- birth weights and growth, Can., 469.
- comparison of types, Ohio, 270.
- cost of feeding, Can., 469.
- feeding experiments, 271, 573, 574; Can., 271; N.Mex., 65; Nebr., 271; Oreg., 66; Tex., 66.
- marketing, Oreg., 66.
- raising in New South Wales, 271.
- raising to market age, cost, Can., 271.
- size at birth, 869.
- systems of production, Ohio, 270.
- time of breeding, Can., 469.
- western, fattening, Ind., 369.
- wintering, 574; Minn., 170; Mont., 171.

(See also Sheep.)

*Laminaria digitata* as famine food, 561.

## Land—

- bank bonds, joint-stock, 593.
- clearing, new developments, 99.
- credit. (See Agricultural credit.)
- development and settlement in Palestine, 792.
- grant colleges. (See Agricultural colleges.)
- holdings, small, in central Italy, formation, 90.
- in Denmark, use, 792.
- plaster. (See Gypsum.)
- reclamation, engineering developments, 99.
- reclamation, Federal, problems, 385.
- revenues in Great Britain, 544.
- situation in England, 199.
- system and national food supply in Great Britain, 391.
- tendency, share, in Spain, 91.
- tenure and settlement in New Zealand, 693.
- tenure, community phases, Nebr., 290.
- tenure, security for allotment holders, 890.

## Landholding systems in Algeria, 793.

## Landowners, British, relation to agricultural industry, 792.

## Lands of California, irrigation requirements, 84.

*Laphygma frugiperda*. (See Army worm, fall.)

## Larch—

- case bearer, control, 844.
- insects affecting, 153.
- longicorn beetle, summary, 848.
- sawfly, control, 844.

*Lasioderma serricorne*. (See Cigarette beetle.)*Lasiodiplodia theobromae*, notes, 248.*Lastophthicus pyrastris*, notes, 156.*Laspeyresia molesta*. (See Peach moth, oriental.)

## Laundering, treatise, 797.

## Laval eradication, 238.

## Lavender, culture and preparation of products, 140.

## Lawn grass—

- glucokinin in, 765.
- seed mixtures, tests, 740.

## Lead—

- arsenate and leaf roller, 844.
- arsenate, colloidal, preparation and properties, 608.
- arsenate, use against tobacco hornworm, U.S.D.A., 53.
- arsenate, water-soluble arsenic in, expression, 205.
- effect on wheat, 820.
- in lead arsenate, determination, 196.
- microchemical detection, 613.
- salts, soluble, effect on plants, 221.
- Leafhoppers, papers on, 844.

## Leaf-roller—

- four-banded, life history studies, Pa., 454.
- red-banded, life history studies, Pa., 454.

## Leaves—

- coloration and fall, effect of weather, 324.
- excretions from, factor in arsenical injury, 525.
- manganese in, variations with age, 221.
- of crop plants, temperature, 425.
- of same ages, comparative structure, 222.
- orientation, mechanism, 225.
- respiration in vacuum or in scant oxygen, 126.

*Lecantum hesperidum*, biology, 255.

## Lecithin of brain in avitaminosis, 862.

## Legumes—

- as affected by sulphur, Oreg., 724.
- chemical study, Oreg., 7.
- culture experiments, S.C., 637.
- insects affecting, 51.
- perennial, wintering, 333.
- plant sap and calcium absorption, 524.
- production in Spain, 795.
- varieties, characteristics, 237.

## Leguminous field crops, insects affecting, 153.



- Lema trilineata*, parasitism of, 849.  
 Lemon extracts, analyses, Conn.State, 160.  
 Lemons—  
   acid and water content at different stages, 752.  
   freezing point, 644.  
   internal decline, 753.  
   vitamin A in, 59.  
*Leperisinus californicus* on ash trees, 259.  
 Lepidoptera Rhopalocera, Trinidad, catalogue, 455.  
*Leptinotarsa decemlineata*. (See Potato beetle, Colorado.)  
*Leptocoris varicornis*, control, 455..  
 Lettuce—  
   bottom-rot disease, 651.  
   downy mildew, a transit disease, 748.  
   drop, control, Mass., 651; Pa., 445.  
   fertilizer experiments, S.C., 642.  
   grading and marketing in South Carolina, 593.  
   seed germination, Minn., 137.  
 Leucite as source of potash, 324.  
 Level, homemade, description, Wash.Col., 687.  
 Levulose, usefulness in insulin cure, 864.  
 Lewis, G. I., biographical sketch, 397.  
 Lice—  
   on cattle, preventive for, Mont., 182.  
   sucking, monograph, 558.  
 Life—  
   duration in *Drosophila*, 824.  
   duration, index of constitutional fitness, 872.  
   standard, in diversified farming section, N.Y.Cornell, 294.  
 Light—  
   artificial, effect on plants, Minn., 126.  
   effect on calcium in serum of rachitic children, 466.  
   effect on growth, 362.  
   exposure and plant lice, 845.  
   rays, supplementary value to vitamin A graded diet, 667.  
   relation to growth of chickens, 780.  
   relation to ophthalmia and growth, 364.  
   requirements of forest trees, Vt., 343.  
   (See also Sunlight.)  
 Lighting systems for farms, 589.  
 Lignocellulose, gelatinization, 509.  
*Limax maxima*, notes, 57.  
 Limberneck of fowls, cause, 482.  
 Limberneck-like disease in fowls, cause, Ill., 383.  
 Lime—  
   absorption of soils, Mass., 621.  
   air slaking, 123.  
   and chalk, relative affects, 820.  
   arsenate. (See Calcium arsenate.)  
   effect on germination of seeds, 325.  
   effect on loss of organic matter from soil, Pa., 422.  
   effect on "sick" soils, 521.  
   effect on sulphate loss from soil, 522.  
   nitrogen. (See Calcium cyanamid.)  
   production in United States, 727.  
 Lime—Continued.  
   production, sale, and use in 1922, 724.  
   requirement of soils. (See Soils.)  
   types, use on soils, 324.  
   use on meadows, 434.  
   use on the farm, 123.  
   use with various fertilizer treatments, Pa., 439.  
   (See also Calcium and Liming.)  
 "Lime-loving," definition of term, 628.  
 Lime-magnesia ratio studies, effect of magnesium toxicity, 625.  
 Limestone—  
   magnesian and nonmagnesian, comparison, 219.  
   solubility, relation to physical property, 218.  
 Lime-sulphur—  
   and calcium caseinate, fungicidal value, 346.  
   dry v. liquid, 346.  
   products, sulphur compounds in, 107.  
 Liming, effect on phosphatic fertilizers, 19.  
 Linkage—  
   in cotton, 633.  
   values, genetic variation in, 129.  
 Linseed—  
   hulls, detection in feeds, 468.  
   oil, phytosterols in, N.Y.State, 408.  
   oil, vitamin A in, 163.  
 Lipoid—  
   formations in plant cells, 23.  
   granulations in plant cells, 125.  
   granulations, use of term, 23.  
*Liponyssus bacoti* attacking man, U.S.D.A., 159.  
 Litmus paper test for soil reaction, 619.  
 Liver, pig's, antirachitic properties, 771.  
 Livestock—  
   breeds in eastern Kongo, 868.  
   cooperative marketing in Ohio, 393.  
   diseases. (See Animal diseases.)  
   feeding, U.S.D.A., 774.  
   industry, American, treatise, 167.  
   industry in Argentina, founders, 573.  
   industry, relation to chemistry, 608.  
   insects affecting, 453.  
   of Great Britain, treatise, 670.  
   poisoning by cocklebur, U.S.D.A., 77.  
   poisoning by greasewood, U.S.D.A., 77.  
   poisoning by white snakeroot, Ind., 181.  
   (See also Plants, poisonous, and specific plants.)  
   range, extension program in, U.S.D.A., 695.  
   Registry Board, report, Kans., 71.  
   remedy law, enforcement, Kans., 77.  
   sanitation, popular articles, 180.  
   shipping associations, accounting records and business methods, U.S.D.A., 92.  
   statistics. (See Agricultural statistics.)  
   (See also Animals; Cattle; Sheep; etc.)

- Locust bean meal in mixed feed, estimation, Mich., 715.
- Locustana pardalina*, life history, 257.
- Locusts—
- brown, life history, 257.
  - economic importance, 257.
  - life history, habits, and control, Colo., 52.
  - long-winged, of the plains, 151.
  - migratory, in Caucasus, 255.
  - notes, 256.
  - seventeen-year. (See Cicada, periodical.)
  - (See also Grasshoppers.)
- Loeb, J., biographical sketch, 599.
- Logan beetle, control, 661.
- Loganberry die-back, notes, 751.
- Logging, treatise, 444.
- Longistigma caryae*, honeydew production by, 557.
- Lophyrus pallipes*, paper on, 255.
- Louisiana Stations, notes, 396, 697.
- Louping-ill in sheep, effect of nutrition, 266.
- Lorostege sticticalis*, life history, 336.
- Lubin, D., biography, 89.
- Lucern. (See Alfalfa.)
- Lumbang oil, hydrogenation, 309.
- Lumber—
- industry and allied trades of Czechoslovakia, 744.
  - industry in United States, treatise, 344.
  - kiln-drying, progress in, 243.
  - market, French, 243.
  - properties and uses, treatise, 838.
  - yard, specifications, U.S.D.A., 187.
  - (See also Timber and Wood.)
- Lunar periodicity in reproduction, 510.
- Lupines, lime sensitiveness, 426.
- Lygidea mendax*, control, 660.
- Lygus solani*, n.sp., description, 154.
- Lymphangitis, bovine, studies, 81.
- Lymphocytes, action of serum on, 379.
- Lyperosia*—
- exigua*, notes, 455.
  - irritans*, effect of food on longevity and reproduction, 456.
- Machinery. (See Agricultural machinery.)
- Macrocentrus ancylihora* n.sp., description, 359.
- Macrocystis pyrifera*, potash from, U.S.D.A., 424.
- Macrophoma*—
- sp., notes, 143.
  - tabaci* n.sp., notes, 248.
- Macrosiphum* spp., tests of nicotin dust on, N.J., 254.
- Macrosporium*—
- carotae*, control, N.Y.State, 546.
  - parasiticum*, pathogenicity, 748.
  - solani*, notes, 550.
- Magnesia and potash fertilization, 724.
- Magnesite, effect on sulphate loss from soil, 522.
- Magnesium—
- effect on potatoes, 235.
  - in blood plasma, determination, 615.
  - induced toxicity, transient nature of, 625.
  - oxid, effect on sulphate loss from soil, 522.
  - production in United States, 727.
  - sulphate, effect on efficiency of carbon tetrachlorid, 684.
- Magnesium-calcium interchange, 819.
- Maguey, grading, baling, and inspection, 434.
- Maine—
- Station, miscellaneous information, 95.
  - Station, notes, 96.
- Maize. (See Corn.)
- Malacosoma disstria*. (See Forest tent-caterpillar.)
- Male as spreader of genital infections, 783.
- Malic acid, inactive, as food acidulent, 58.
- Mallow rust, studies, 250.
- Malnutrition—
- campaign against, 796.
  - determining, 764, 854.
  - (See also Nutrition and Undernutrition.)
- Malt diastase, effect on sorgo juice, 509.
- Malta fever—
- and abortion, causative organisms, relation, 183.
  - case in Baltimore, 684.
- Maltose formation in sweet potatoes, 711.
- Mammals—
- age and chemical development, 569.
  - oestrus and ovulation in, 531.
  - (See also Animals and specific kinds.)
- Man—
- age and chemical development, 569.
  - endoparasites of, Minn., 152.
  - inheritance of webbed toes in, 530.
  - lepidopterous enemies, 156.
  - rat mite attacking, U.S.D.A., 159.
- Manganese—
- and vitamins, association, 463.
  - content of leaves, variations with age, 221.
  - in plants, 21.
  - in soils of Netherlands, 514.
  - localization in plants, 221.
- Mange—
- occurrence in Great Britain, 182.
  - of horses, notes, 582.
- Mangels—
- cost studies, Can., 432.
  - fertilizer experiments, West.Wash., 520.
  - v. dried beet pulp for cows, Can., 375.
  - variety tests, Can., 432, 533; Minn., 133.
  - yields, Can., 432.
- Mango bark discolorations, 150.



- Mangoes—  
grafting, 543.  
varieties, P.R., 540.
- Manila hemp. (*See* Abaca.)
- Manure—  
effect on nitrogen-fixing power of soil, Utah, 120.  
fertilizing value, Minn., 121.  
hot composted, fertilizing value, 421.  
liquid, conservation of nitrogen in, 721.  
liquid, use in Europe, 621.  
nitrogen losses from, 421.  
production, care, and use, 322.  
reducing amount used, Mass., 642.  
use on meadows, 434.  
(*See also* Cow manure.)
- Maple—  
borer, notes, Conn.State, 50.  
products, lead number, 196.  
sesian, notes, Conn.State, 50.  
sirup and sugar production, U.S.D.A., 744.  
wood, abnormalities of growth, cause, 428.
- Marasmius sacchari*, notes, 352.
- Mares, thoroughbred, length of gestation period, 174.
- Margarin. (*See* Oleomargarin.)
- Marine products of commerce, treatise, 709.
- Market reports, U.S.D.A., 92, 294, 491, 691, 894.
- Marketing—  
and distribution, 491.  
cooperative, 894.  
cooperative, discussion, 197.  
cooperative, in United States, 291.  
cooperative, treatise, 192.  
effect of farm storage, 97.  
in North Carolina, N.C., 92, 294, 793.  
northwestern apples, treatise, 393.  
organization of Federated Fruit and Vegetable Growers, 393.  
organization, problems, 392, 594.  
principles, 593.  
roadside, in Connecticut, 91.
- Marl—  
production in United States, 727.  
use in road construction, 386.
- Marog, effect on nitrification in soil, 721.
- Marshland, fertilizer experiments, Can., 533.
- Marsupials—  
male meiotic phase in, 329.  
spermatogenesis in, 329.
- Maryland Station, report, 898.
- Massachusetts—  
College, notes, 96, 498, 798, 899.  
Station, notes, 96, 498.  
Station, report, 696.
- Mast cell in lower vertebrates, 783.
- Mayetiola destructor*. (*See* Hessian fly.)
- Meadow fescue. (*See* Fescues.)
- Meadows—  
fertilizer experiments, 122, 433; Can., 533.
- Meadows—Continued.  
length of life, N.Y.Cornell, 230.  
weed control in, 338.  
(*See also* Hay, Grass, and Grassland.)
- Mealybugs—  
biological control, 661.  
on house plants, summary, Mich., 454.  
(*See also* Citrus mealybug.)
- Meat—  
cold storage, molds on, 763.  
frozen, vitality of tapeworm in, 582.  
industry, American, treatise, 167.  
industry of Great Britain, 168.  
industry of world, treatise, 670.  
inspection in Norway, 582.  
scrap, estimation of bone in, Mich., 715.  
(*See also* Beef, Pork, etc.)
- Media. (*See* Culture media.)
- Medicinal plants. (*See* Drug plants.)
- Medicine, tropical, studies, 783.
- Medicines, chemical nature, 880.
- Megalonectria caespitosa*, notes, 143.
- Megalopyge opercularis*, effects of sting on man, 258.
- Melanoplus* spp., life history, habits, and control, Colo., 52.
- Melitara junctolineella*, seasonal adaptation in southern hemisphere, 558.
- Melitensis-abortus group, nomenclature, 183.
- Melittobia acasta*, notes, 360.
- Melolontha vulgaris* larvae, destruction, 457.
- Melophagus ovinus*, transmission of trypanosomes by, 357.
- Menstrual cycle and basal metabolism, 460.
- Mercury—  
compound, new, with powerful germicidal properties, 284.  
vapor quartz lamp irradiations, effect on normally fed rats, 265.
- Merodon—  
*equestris*, control, 452.  
*equestris*, studies, 156.
- Mesquite beans, chemical and structural study, U.S.D.A., 501.
- Metabolism—  
basal, and menstrual cycle, 460.  
basal, during vitamin B starvation, 63.  
experiments, improved procedure, 367.  
experiments with ruminants, 573.  
inorganic, studies, 570.  
plant, temperature effects in, 20.
- Metaleurodicus manni* n.sp., description, 155.
- Metals—  
in food, colorimetric determination, 613.  
of cooking utensils, solubility, 763.  
"Metaphen," properties, 284.
- Meteorological—  
and climatological bibliography of Argentina, 208.  
instruments, wiring instructions, U.S.D.A., 716.

## Meteorological—Continued.

observations, Mass., 116, 510, 809;  
Me., 13; U.S.D.A., 115, 116, 415,  
510, 808.

observations at Requena, 316.

observations in England and Wales,  
316.

records for 1922, Mont., 116.

service, British, use to farmers, 207.

service of Brazil, 13.

## Meteorology—

agricultural, development, 13.

development, 808.

effect on leaf coloration and fall, 324.

papers on, U.S.D.A., 115, 415, 808.

simplified, treatise, 314.

treatise, 313.

(See also Climate, Rainfall, Tempera-  
ture, Weather, etc.)

Methoxyl products from wood distillation,  
206.

## Methyl—

alcohol, detection, 803.

alcohol in ethyl alcohol, detection, 804.

anthranilate in grape beverages and  
flavors, 204.

## Methylene blue—

absorption by cotton, 413.

use against abortion, Vt., 381.

Mica minerals, source of potassium for  
plants, 521.

Mice, age and chemical development, 569.

(See also Mouse.)

## Michigan—

College, notes, 599, 697.

Station, quarterly bulletin, 496.

*Micrococcus* spp., notes, U.S.D.A., 258.

*Micromus posticus*, life history, 558.

Microorganism, Gram-negative, of avian  
diphtheria, 285.

(See also Bacteria and Organism.)

Micropipette holder, description, 612.

Micropsylla, new genus, notes, 359.

Microsomes in plant cells, 23.

Mildew, powdery, control, 346.

(See also host plants.)

## Milk—

acidophilus, therapeutic value, 161.

active chlorin as germicide for, 679.

and distillery residues, feeding value,  
266.

and its uses, U.S.D.A., 58.

and oranges, value in school lunches,  
563.

as supplementary meal for undernour-  
ished children, 855.

bacteria in, relation to temperature,  
876.

bacterial analysis, methods, 877.

bacterial analysis, pin point colonies  
in, 877.

bacterial count, factors affecting, 876.

bottles, Babcock test, calibrating, 413,  
714.

bottles, washing and sterilizing, 877.

calcium and inorganic phosphorus in,  
609.

## Milk—Continued.

calcium content, effect on cheese mak-  
ing, 378.

clean, for small towns, 877.

clean, production, premiums for, 877.

coagulated, analysis, 805.

condensed, solids in, determination,  
202.

condensed, sweetened and unsweetened,  
378.

cooling, 875.

copper in, solubility, 178.

cost of production in France, 191.

cost of production in Scotland, 191.

cryoscopy, Conn.State, 112, 160.

diet, effect on skeleton, 361.

evaporated, solids in, determination,  
202.

fat content at different periods of  
lactation, Can., 781.

fat content, relation to acidity, 875.

fat determination, methods, 806.

fat percentage and yields, relation,  
Ill., 75, 676.

fat percentage, factors affecting, 475.

fat percentage of different lactations,  
178.

fat percentages, effect of age, Me., 74.

fat production, comparative value of  
foods, 579.

fat production increase, relation to  
weight, 578.

fat test of cream, factors affecting,  
Ind., 178.

fat test, 2-day official, factors affect-  
ing, 178.

feeding value, Wash.Col., 277.

flavor and odor, effect of feed, U.S.  
D.A., 376, 377.

formulas, 278.

goat's and cow's, composition, 266.

human, analyses, Conn.State, 160.

human, inorganic constituents, racial  
variations, 562.

in Japan, laws governing sale, 876.

lactic acid, as infant food, 856.

lactose in, polariscopic determination,  
714.

leaving in udder before test, effect, Pa.,  
474.

marketing in six cities, Kans., 593.

mineral constituents, 161.

of Danish cows, composition, 781.

of goats and ewes, analyses, 875.

off-flavors produced in, 878.

ordinance, best type, 876.

pasteurization, 580, 878.

pasteurization, conference on, 782.

pasteurization for cheese making, 679.

pasteurization in glass enameled tank  
or bottle, S.Dak., 75.

pasteurized, high counts in, 878.

paying on quality basis, Mich., 475.

plant, erecting, 876.

plants, test for locating improper pas-  
teurization or contamination, Mich.,  
278.



## Milk—Continued.

- powders, keeping qualities, Minn., 179.
  - production and cows, treatise, 577.
  - production in China, 875.
  - production, soy beans v. alfalfa hay for, W.Va., 73.
  - production, studies, Ky., 873.
  - production with low bacterial count, 781.
  - properties as affected by heat, Pa., 411.
  - protein modifications for pigs, Iowa, 172.
  - protein-free, distribution of sulphur in, 710.
  - quality and adulteration, 278.
  - ration for calves, addition of hay and grain to, 275.
  - recording, value, 278.
  - ropy, Ohio, 580.
  - samples, examination, 878.
  - secretion, effect of gestation, 278.
  - secretion, effect of underfeeding, 177.
  - secretion, relation to growth and senescence, 578.
  - secretion, studies, 178, 277, 278, Me., 74.
  - shops, regulations governing in England, 279.
  - skimmed. (*See* Skim milk.)
  - solids in, determination, 202.
  - souring, streptococci of, 279.
  - spray process of drying, effect on vitamin C in, 564.
  - supply of New Haven, improving, 876.
  - temperature and bacterial content, 876.
  - transportation, 876.
  - transportation, rates, and methods, 581.
  - viscosity, relation to creaming, Minn., 179.
  - vitamin A value of, 567.
  - vitamins in, 857; Minn., 175.
  - vitamins in, effect of autoclaving, 62.
  - yield variations with age and lactation period, 580.
- Milking machines, practicability, Tex., 177.
- Millet—
- culture experiments in Sweden, 735.
  - for silage, variety tests, Can., 432.
  - pollination habits, 639.
  - smut, treatment, 349.
  - vitamin A content, 364.
- Millipedes on lettuce and carrots, Pa., 454.
- Milo, smut resistance in, 243.
- Mineral—
- metabolism, relation to acid-base equilibrium, 664.
  - plant food, availability, 21.
  - requirements of animals, 266.
  - resources, nonmetal, of United States, 820.
  - resources of United States, 727.
  - soils, exchange acidity of, 514.
- Minerals, value for growing chicks, 872.

## Minnesota—

- Station, notes, 798.
  - Station, report, 195.
  - University, notes, 397, 798.
- Mint, culture and preparation of products, 140.
- Miscibility, studies, 805.
- Missouri—
- State Poultry Association yearbook, Mo., 871.
  - Station, notes, 798, 899.
  - University, notes, 798, 899.
- Mites, dermanyssid, of North America, 851.
- Mitochondria—
- effects of temperature, 325.
  - in plant cells, 125.
  - parasitism and resistance, 244.
  - reaction against parasitism, 22.
  - rôle in formation of plant substances, 223.
- Moisture index of peach buds, Md., 126.
- Molasses—
- beet pulp. (*See* Beet pulp.)
  - blackstrap, feeding value, Miss., 69.
  - effect on cane soils, 820.
  - solids in, determination, 202.
  - waste, potash from, 324.
- Mold fungi in sugar inversion, 728.
- Molds—
- destruction of pentosans by, 110.
  - effect on keeping quality of butter, 476.
  - on cold storage meat, 763.
- Monarthropalpus buxi*, control, 559.
- Monilia*—
- oregonensis* n.sp., description, Oreg., 843.
  - sitophila*, penetration into hardwood, 656.
- Monochaetia rosenwaldia* n.sp., description, 450.
- Monodontomerus, genera close to, European species, 256.
- Mononchus papillatus* for control of plant-injurious nemas, 251.
- Monotropa, biology, studies, 225.
- Monotropomyces nigrescens*, suggested name, 225.
- Montana—
- College, notes, 900.
  - Station, notes, 900.
  - Station, report, 195.
- Morrill, J. S., biography, 603, 693.
- Mosaic—
- and related diseases in Idaho, 745.
  - disease, studies, 351, 648, 651.
  - virus, nature, 746.
  - (*See also specific host plants.*)
- Mosquito larvae—
- effect of oil on, 847.
  - toxicity of acids for, 357.
- Mosquitoes—
- and drought of 1921, 255.
  - behavior, relation to atmospheric conditions, N.J., 757.
  - control, Conn.State, 50.
  - of France, natural history, 758.

- Mosquitoes—Continued.  
 preferential feeding experiments, 259, 847.  
 yellow fever, notes, U.S.D.A., 53.  
 (See also Anopheles.)
- Motor—  
 fuel, volatility, 887.  
 transportation, treatise, 189.  
 truck tires, impacts from obstructions in roads, 286.  
 trucks, rear axles, types of, 287.
- Mottling disease of sugar cane. (See Sugar cane.)
- Mouse typhoid—  
 epidemics, theory, 784.  
 immunization experiments, 787.  
 infection, virulence and host susceptibility, 478.
- Muck soils—  
 fertilizer experiments, West.Wash., 520.  
 of North Carolina, nitrification and acidity, N.C., 320.
- Mucor—  
*glomerula* in soil, activities, 620.  
*stolonifer*, parasitic action, mechanism, 244.
- Mud, Canton and Chinese fish pond, composition, 319.
- Mulberry scale, parasite of, 459.
- Mulching experiments, Mo., 15.
- Mules—  
 production, U.S.D.A., 71.  
 soy beans for, Ill., 675.
- Mungo beans—  
 breeding experiments, P.R., 533.  
 disease of, S.C., 648.
- Musca—  
 spp., notes, 358.  
 spp., transmitters of *Habronema*, 455.  
*vetustissima*, life history, 359.
- Muscidae, Indian, notes, 156.
- Muscle, skeletal, insulin-like substance in, 864.
- Muscoid flies, chalcid parasites of, 359.
- Muscovite, potassium content, 521.
- Mushrooms—  
 edible, vitamin in, 856.  
 of Ontario, 643.
- Muskmelon downy mildew, control, S.C., 648.
- Muskmelons—  
 breeding experiments, P.R., 540.  
 variety tests, U.S.D.A., 138.
- Mutation—  
 among hog cholera bacilli, 788.  
 black-eyed yellow, in rats, 822.  
 in *Drosophila*, studies, 823.  
 inheritance, 729.  
 reverse, in *Drosophila*, 331.
- Mutillidae of Minnesota, 755.
- Mycological and phytopathological notes, 142.
- Mycology, Portuguese glossary, 345.
- Mycosphaerella*—  
*citrullina*, notes, 651.  
*rubina*, notes, 751.
- Myriangium* sp. on grapefruit, 752.
- Myzus*—  
*persicae*. (See Peach aphid.)  
*ribis*. (See Currant aphid.)
- Nabis* spp., life history, 453.
- Narcissus—  
 flies, large and small, 156.  
 nematode disease, notes, 452.
- Nasonia brevicornis*—  
 notes, 359.  
 structure and development, 356.
- National—  
 Education Association, proceedings, 896.  
 Research Council, new building for, 601.
- Nature study for elementary schools, course of study, 796.
- Necator americanus*, pharynx and alimentary canal, 160.
- Necrobacillosis, summary, Colo., 684.
- Necrology, notes, 499.
- Nectria*—  
*cinnabarina*, notes, 248.  
*galligena* in Pacific States, 148, 750.  
 spp., notes, 42.
- Negro—  
 Land-Grant College presidents, conference, 498.  
 schools, home-making courses in, 597.
- Negroes, teacher-training institutions for, 495.
- Nematode resistance in peach, transmission, 140.
- Nematodes—  
 control with hot water, Va.Truck, 843.  
 parasitic on cultivated plants, 452.  
 predatory, for control of plant-injurious nemas, 251.  
 stem and bulb infesting, 754.  
 summary, 51.
- Neoeurhynchothrips, new genus, description, Fla., 660.
- Nephantis serinopa*, notes, 455.
- Nephelometer, modifications, 312.
- Nests, trap, types, Can., 779.
- Nettle, fiber content, estimating, 335.
- Neuritis in poultry, 685.
- Nevada Station, notes, 599.
- New Jersey Stations, notes, 698.
- New York—  
 Cornell Station, research activities, 898.  
 State Station, notes, 397, 698, 900.  
 State Station, report, 597.
- Nezara viridula*—  
 on pecan, 556.  
 studies, 52.
- Nickel catalyst, preparation, 309.
- Nicotin—  
 dust, making and use, N.J., 254.  
 dust, paper on, 844.  
 dust, progress in use of, 658.  
 gas, evolution from carrying substances, 254.  
 toxicity, relation to volatility, 658.



## Nitrate—

- deposits, Chilean, origin, 122.
- formation in soil, effect of time of year, 17.
- of ammonia. (*See* Ammonium nitrate.)
- of soda. (*See* Sodium nitrate.)
- situation, Chilean, 323.

## Nitrates—

- fertilizing value, Minn., 121.
- from atmospheric nitrogen, 722.
- in soil at Pusa, movements, 210.

## Nitrification—

- as affected by potassium fertilizers, 818.
- as affected by sulphur oxidation, 726.
- effect of temperature, 516.
- in muck soils, N.C., 320.
- in Sudan soils, 816.
- methods of study, 118.
- relation to pH value, 722.
- studies, 320.

## Nitrifying bacteria, relation to reactions and concentrations of media, 516.

## Nitrogen—

- ammoniacal method of determining, 9.
- and calcium relation in plants, 524.
- applications, effect on set of apples, 299.
- atmospheric, fertilizers, test, U.S.D.A., 621.
- atmospheric, fixation by activated sludge, 323.
- atmospheric, nitrates and ammonia from, 722.
- effect on meadows, 434.
- effect on "sick" soils, 521.
- fertilization experiments on pastures, 122.
- fixation, arc process for, 722.
- fixation, effect of humus, 120.
- fixation, effect of magnesian limestone, 219.
- fixation, research on, 721.
- fixation, studies in Punjab, 210.
- fixing powers of soil, factors affecting, Utah, 119.
- in barley, factors affecting, 233.
- in blood of avitaminous and starving pigeons, 565.
- in rain and snow, 716.
- in sewage tanks, origin, 791.
- lime. (*See* Calcium cyanamid.)
- loss from soil, Pa., 422.
- losses from manure, urine, etc., cause, 421.
- organic, decomposition in rice soils, 815.
- recovery from sewage, 124.
- treatment of soil, effects, 624.

## Nitrogenous—

- fertilizer, Rehmsdorf organic, tests, 623.
- fertilizers, effect of time of application, 623.

## Nitrogenous—Continued.

- fertilizers in German agriculture, use, 423.
- fertilizers, physiologically acid and alkaline, action, 423.
- Noctua c-nigrum*, life history notes, Mass., 659.
- Nomography, theory, 586.
- Nondisjunction, high and low, in *Drosophila*, 730.
- North Carolina—
  - College, notes, 699.
  - Station, notes, 699.
- Northeastern Forest Research Council, organization, 700.
- Nosema apis*—
  - Infection, pathological conditions, 561; Minn., 156.
  - summary, 260.
- Nuclei, morphological studies, 225.
- Nuclein decomposition, factors affecting, 720.
- Nursery—
  - inspection, notes, Conn.State, 50.
  - small, establishment, treaties, 540.
  - trials, experimental error in, control, 229.
- Nut oil, hydrogenation, 309.
- Nutrient solutions, absorption by plants, 524.
- Nutrition—
  - and clinical dietetics, treatise, 762.
  - animal. (*See* Animal nutrition.)
  - bacterial, studies, 184, 879.
  - cooperative course in, 797.
  - handbook, 597.
  - human, extension program in, U.S.D.A., 695.
  - indexes, use of weight-height-age tables, 853.
  - of children, standards, 460.
  - science of, treatise, 852.
  - studies in Russia during famine, 561.
  - teaching, 597.
  - (*See also* Diet, Malnutrition, Under-nutrition, etc.)
- Oak—
  - American white, hemicellulose of, 311.
  - cork, culture in Spain, 40.
  - cork, in Tunis, 744.
  - sapling borer, studies, 662.
- Oat—
  - and pea hay, rotation experiments, R.I., 520.
  - black rust, notes, 548.
  - blade blight, resistant varieties, 246.
  - crown rust, dissemination, U.S.D.A., 43.
  - crown rust, infection capabilities, 548.
  - crown rust, notes, 548.
  - crown rust, studies, 746.
  - grass, duration in meadows, N.Y., Cornell, 231.
  - halo blight, notes, 548.
  - hulls, use in feeding stuffs, 367.

- Oat—Continued.  
 loose smut, control, 347.  
 loose smut, notes, 548.  
 mildew, notes, 548.  
 seed treatment, effect, 736.  
 seedling blight, cause, 648.  
 smut, control, 245, 549, 648, 649, Pa., 446.  
 smut, hot water treatment, Can., 447.  
     (See also Smut.)  
 stem rust resistance, breeding for, 246.  
 straw, for wintering lambs, 574.
- Oats—  
 as silage crop, Alaska, 532.  
 assimilation of nutrients, relation to soil fertility, 18.  
 black stem rust resistance, inheritance of, Minn., 143.  
 breeding experiments, Minn., 132.  
 certification in Germany, 439.  
 cost of production, Can., 592; Ind., 389.  
 cost studies, Can., 432.  
 culture experiments, Alaska, 532; Can., 231.  
 effect of different pH values, 232.  
 false wild, delayed germination and origin, 531.  
 fertilizer experiments, 423; Minn., 121.  
 for wintering lambs, 574.  
 from Volga region, composition, 169.  
 giant aberrants, 32.  
 growth, effect of seed treatment, 736.  
 multiflorous variation in, 227.  
 naked, characteristics, 227.  
 prolific and other dwarf, 822.  
 rate of manuring tests, Minn., 120.  
 rotation experiments, N.Y. State, 422.  
 seeding experiments, Minn., 132.  
 varieties, characteristics, 237.  
 varieties for seed in Poland, 439.  
 varieties, fungus diseases on, 548.  
 variety tests, Can., 432, 533; Minn., 133; Mont., 133; Pa., 432; West. Wash., 134.  
 water requirements, 828.  
 whole, v. chop, feeding value, 272.  
 yields, Can., 432.
- Oberly, E. R., memorial prize, 900.
- Oceanthus niveus*, notes, V.I., 555.
- Oenophthira pilleriana*—  
 parasites of, 561.  
 studies, 659.
- Oestrous cycle—  
 in mammals, comparison, 635.  
 in mice, 635, 826.  
 in the opossum, 636.  
 relation to morphological and physiological changes, 635.
- Oestrus and ovulation in mammals, 531.
- Oestrus ovis*, human infection from, 259.
- Office of Experiment Stations, monograph, 606.
- Ohio—  
 Station, monthly bulletin, 195, 598.  
 Station, notes, 699.  
 University, notes, 900.
- Oidium, infection and developmental experiments, 143.
- Oidium lactis*, effect on keeping qualities of butter, 476.
- Oil—  
 cake, feeding value, Can., 470.  
 cake meal v. tankage for pigs, Can., 776.  
 emulsions, constitution, 554.  
 emulsions, new method of making, Mo., 51.  
 emulsions, preparation, simplified method, 657.  
 in cotton seed, relation to gossypol, 111.  
 meal, feeding value, Ohio, 170.  
 seeds, insects affecting, 153.
- Oiled wrappers for apple-scald control, 841; U.S.D.A., 552.
- Oils—  
 acetyl values, determination, 11.  
 and fats, technology, colloid chemistry in, 801.  
 and fats, unsaponified matter, 196.  
 catalytic hydrogenation, 610.  
 ethereal, plants producing, 140.  
 hydrogenated for oil baths, 201.  
 Philippine, hydrogenation, effect of composition, 309.  
 vegetable, as engine fuel, 588.  
 vegetable, detection of olive oil in, 313.  
     (See also Fats, Corn oil, Cottonseed oil, Olive oil, etc.)
- Oklahoma—  
 College, notes, 699.  
 Station, notes, 699.
- Oleomargarin, manufacturing uses, 365.
- Oligonychus americanus*, notes, Conn. State, 50.
- Olive—  
 industry, 645.  
 knot organism, pathogenicity, 752.  
 oil, detection in vegetable oils, 313.  
 trees, longevity, 743.
- Olives, decomposition during pickling, Calif., 414.
- Onchocerca*—  
*bovis*, notes, 359.  
*gibsoni*, transmission, 260.
- Onchocerciasis*, bovine, possible transmitters, 358.
- Oncoscelis sulcipectus*, control, 454.
- Onion—  
 blight, notes, 243.  
 disease in Porto Rico, 748.  
 extract, glucokin in, 765.  
 leaf spot, notes, 243.  
 smut, control, 349.  
 smut treatment, relation to rain, 748.
- Onions—  
 Bermuda, culture experiments, V.I., 540.  
 dormancy studies, 300.  
 improved strain, U.S.D.A., 137.  
 overhead irrigation studies, Minn., 139.



Ontario Agricultural College, notes, 900.

*Oospora scabies*. (See Potato scab.)

**Ophiobolus—**

*cariceti*, notes, 549, 746.

*cariceti*, pathogenicity, 145.

**Ophthalmia—**

and growth, relation to light, 364.

effect of dried spinach in diet, 263.

histological study of paraocular glands, 464.

in rats on vitamin A deficient diet, 60.

of cattle, studies, 184.

*Ophthalmia myiasis externa* due to *Oestrus ovis*, 259.

Ophthalmology, textbook, 379.

**Orange—**

pest, new, from Honduras, 155.

rusts of *Rubus*, effect on development of stomata, 354.

rusts, systematic infections of *Rubus* with, 149.

tree bug, control, 454.

trees, effect of sodium, potassium, and calcium, Calif., 327.

**Oranges—**

and milk, value in school lunches, 563.

changes during storage, 239.

freezing point, 644.

navel bud selection as related to yield, 644.

Satsuma, in south Mississippi, Miss., 38.

vitamin A in, 59.

**Orchard—**

grass, breeding experiments, Can., 433.

grass, duration in meadows, N.Y. Cornell, 231.

heating, studies, U.S.D.A., 807.

inspection. (See Nursery inspection.)

pests in Washington State, 844.

practices, correlation with growth and production, 37.

stand of trees, 441.

**Orchards—**

management, Mont., 139.

pruning experiments, Minn., 138.

soil management, 441; Can., 339.

(See also Fruits, Apples, Peaches, etc.)

**Oregon—**

College, notes, 397.

Station, notes, 397.

**Organic—**

matter, effect on active aluminum, R.I., 17.

matter in soil, 815.

matter in soil, effect on productivity, 721.

matter, loss from soil, Pa., 422.

nitrogen, availability in fertilizers, 196.

syntheses, treatise, 709.

Organism, acid-fast, as cause of lymphangitis, 81.

(See also Bacteria and Microorganism.)

Oriental peach moth. (See Peach moth.)

Orientation in plants, studies, 225.

Ornithology, British, bibliography, 252.

Orthoclase, potassium in, availability, 19.

*Oscinosoma frit*, parasites of, 255.

Osmosis in soils, relation to plant growth, 211.

**Osmotic pressure—**

of juices from parts of potato plant, 628.

of soil solution, 317.

**Osteomalacia—**

hunger, in Vienna, 568.

in cattle in Norway, 185.

Otocariasis of foxes, Minn., 153.

Otocephaly in guinea pigs, 527.

*Otodectes cynotis*, notes, Minn., 153.

Otters, treatise, 355.

Ovaries, mammalian, types, 826.

Ovulation and blood sugar, relation, 867.

Oxygen, dissolved, determination 201.

Oxygen-supplying power of soils, determination, 22.

Oysters, vitamin C in, 465.

**Ozone—**

atmospheric, absorption of ultra-violet rays by, 315.

of upper air, rôle in plant and animal life, 208.

**Ozonium omnivorum—**

habits, 747.

notes, Tex., 45.

*Pachyocrepideus dubius*, notes, 359.

Pacol, grading, baling, and inspection, 434.

Paddy. (See Rice.)

Pageant for rural schools, 95.

Paint plasticity, factors affecting, 686.

Painting, principles and practices, treatise, 590.

**Palm—**

bud rot in southern India, 552.

coconut. (See Coconuts.)

kernel meal, vitamin content, 64.

kernel proteins, growth-promoting value, 64.

nut cake, feeding value, 367.

Supari, koleroga disease, notes, 243.

**Palms—**

insects affecting, 51.

oil, of Dutch East Indies, 647.

Palomaria oil, hydrogenation, 309.

Pan American Scientific Congress, notes, 700.

Pancreas and parathyroids, relation, 765.

*Panicum* spp., analyses, 168.

**Paper—**

making, suitability of various woods for, 142.

pulp, hemp, and wood fibers in, estimation, 509.

(See also Pulp wood.)

Parabiosis in study of deficiency diseases, 858.

*Paracrias phytomyzae*, notes, 661.

- Paradichlorobenzene—  
 as grain fumigant, Minn., 152.  
 for peach borer control, 155; Conn. State, 50; N.J., 455; N.Y. State, 555.  
 for root-eating cane grubs, 457.
- Paralysis due to ticks, 762.
- Parana pine lumber industry of Brazil, 40.
- Parasites—  
 imported, refrigerator for shipping, 657.  
 introduced, retarded establishment of, 845.  
 vegetable, of cultivated plants, 244.  
 (See also Animal parasites and specific forms.)
- Paratetranychus*—  
*bicolor*, notes, Conn. State, 50.  
*pilosus*, studies, Conn. State, 851.  
*ununguis*, notes, Conn. State, 50.
- Parathyroid glands, effect of calcium deficiency, 162.
- Parathyroids and pancreas, relation, 765.
- Paratyphoid—  
 fever, immunization, oral route for, 478.  
 of fowls, 586.
- Paria canella quadrinotata* and *gilvipes*, summary, U.S.D.A., 55.
- Pasteurization. (See Milk and Cream.)
- Pasture—  
 and hay mixtures, comparison, Can., 433.  
 grasses, useful, 434.  
 plants, length of life, N.Y. Cornell, 230.
- Pastures—  
 chemical fertilizers on, 322.  
 nitrogen fertilization experiments, 122.  
 of West Virginia, W.Va., 867.  
 weed control in, 338.  
 (See also Grasses and Meadows.)
- Pathology—  
 and genetics, relation, 328.  
 textbook, 180.
- Pavement slabs, rigid, warping, 790.
- Pavements. (See Concrete and Roads.)
- Pea—  
 anthracnose, description, 146.  
 aphids, control, 557.  
 bacterial disease, notes, S.C., 648.  
 seed weight, relation to resulting crop, 636.  
 stem root rot, notes, 839.
- Peach—  
 aphid, green, control, 557.  
 aphid, green, on spinach, Pa., 453.  
 borer, control, 155, 453; Conn. State, 50; N.J., 455; N.Y. State, 555.  
 brown rot, control, 450, 552.  
 bud rot, notes, 842.  
 buds, moisture index in winter and spring, Md., 126.  
 leaf curl, control, 451.  
 leaf curl, notes, 249.  
 little disease, dissemination, 751.  
 mildew, notes, 249.
- Peach—Continued.  
 moth, oriental, summary, 558.  
 parasites, 453.  
 root borer, control, Oreg., 53.  
 shot-hole borer, control, 453.  
 wilt disease, new, 751.  
 yellows, dissemination, 751.
- Peaches—  
 breeding in New Jersey, 543.  
 culture experiments, Can., 340.  
 culture experiments in Arizona, U.S. D.A., 138.  
 culture in Missouri, Mo., 836.  
 fertilizer experiments, Mass., 642; S. C., 642.  
 nematode resistance, 140.  
 nematode resistance in, transmission, 751.  
 post-harvest dusting experiments, U.S. D.A., 662.  
 thinning test, Can., 340.  
 varieties, nursery identification, 643.
- Peanut—  
 butter, analysis, 610.  
 cake, feeding value, 367.  
 grazing for pigs, Tex., 71.  
 gummosis, studies, 347.  
 meal, digestibility, Mass., 168.  
 meal v. corn meal for milk production, Can., 375.  
 shells, digestibility, Mass., 168.  
 tikka disease, 146.  
 warehouses, regulation, U.S.D.A., 594.
- Peanuts—  
 breeding experiments, S.C., 637.  
 culture, 637.  
 detection in feeds, 468.  
 feeding value, Miss., 68.  
 variety tests, 828; U.S.D.A., 132.
- Pear—  
 brown heart, cause, 449.  
 canker, European, in Oregon, 148.  
 insects, control, N.Y. State, 555.  
 powdery mildew, outbreak, 750.  
 trees, starch storage in, 835.
- Pears—  
 aleurodid enemy of, 556.  
 blight resisting variety, 37.  
 composition, effect of tree chlorosis, 248.  
 culture experiments in Arizona, U.S. D.A., 138.  
 fertilizer experiments, Mass., 642.  
 pineapple, botany and history, Ga., 543.  
 pruning and fertilizing, 441.  
 starch stored in, 299.
- Peas—  
 abnormality in heredity of embryo color, 331.  
 analyses, Oreg., 7.  
 as affected by sulphur, Oreg., 724.  
 canned, flat sours of, Mich., 459.  
*Colletotrichum pist* on, 652.  
 culture experiments, Alaska, 532; Can., 231.  
 selected strains, Minn., 138.



## Peas—Continued.

- time of planting tests, Can., 440.
- v. barley for pigs, Can., 776.
- variety tests, U.S.D.A., 132.
- water requirements, 828.

## Peat—

- investigations, value to cranberry industry, 321.
- lands, first breaking, 388.
- of Italy, analyses, 419.
- passive biological nature, 720.
- production in United States, 727.
- soils, management, Minn., 120.
- soils, treatment, 321.

## Pecan kernel spot, 556.

## Pecans—

- culture experiments in Arizona, U.S.D.A., 138.
- imported, in South Africa, 837.

## Pectin—

- and protopectin, 310.
- extracts, jellying power, relation to alcohol precipitate, 508.

*Pectinophora gossypiella*. (See Cotton bollworm, pink.)*Pegomyia brassicae*. (See Cabbage maggot.)

## Pellagra—

- and protein, discussion, 164.
- prevention by diet, 669.

*Pempheres affinis*, notes, 57.*Penicillium*—

- divaricatum*, penetration into hardwood, 656.
- glaucum*, parasitic action, mechanism, 244.
- spp. in soil, activities, 620.
- spp., utilization of citric acid by, 630.

## Pennsylvania—

- College, notes, 599, 699.
- Station, author index of publications, 95.
- Station, notes, 699.
- Station, report, 496.

## Pennycress, garlic-scented weed new to Britain, 439.

*Pentaptera paniculata*, distribution and characters, 40.

## Pentosans, destruction by molds, 110.

## Pentose detection, 803.

## Peony diseases, 354.

## Pepper black fruit disease, 447.

## Peppers, yield as affected by irrigation, Mo., 15.

## Perennials, treatise, 39.

## Perfumes and cosmetics, treatise, 308.

*Peridermium strobil* and *Cronartium ribicola*, relation, 150.

(See also White pine blister rust.)

*Peridesmia phytonomi* n.sp., description, 260.*Perillitus eleodis*, notes, 850.*Perillus bioculatus*, life history and biology, 755.

## Permian Red Beds of Oklahoma, phosphate in, 218.

## Peromyscus, subspecific hybrids in, 822.

*Peronospora trifoliorum*, notes, 447.

## Pest law of Colorado, 151.

## Petunia, polymorphism in, 631.

## Phaeophytin in silage, 268.

## Phenological observations, 616.

Phenols, toxicity for *Sterigmatocystis nigra*, 245.*Philaenus lineatus*, abdomen and genitalia, 844.

## Phlobatannins in plant tissue, 427.

## Phlox, inheritance of flower color and form, Pa., 430.

*Phoma*—

*insidiosa* on sorghum, 148.

*musae*, notes, 752.

*solanicola*, notes, 248.

*theobromae* n.sp., notes, 42.

*Phomopsis citri*—

control, U.S.D.A., 149.

utilization of citric acid by, 630.

*Phorocera cleripennis*, notes, U.S.D.A., 258.

## Phosphate—

in Permian Red Beds of Oklahoma, 218.

rock, in Tennessee, mining and washing, 323.

rock, production in United States, 727.

rock, solubility, effect of fineness, 412.

situation in Germany, 323.

## Phosphates—

behavior in soils, 723.

comparative availabilities, 723.

comparison, 19; N.Y.State, 422; Pa., 423, 424.

effect on acid soils, R.I., 17.

efficiency, effect of liming and time in soil, 19.

fertilizing value, Minn., 121.

in blood plasma, determination, 615.

in Hawaiian soils, Hawaii, 216.

raw, use, 323.

(See also Superphosphate.)

## Phosphatic—

fertilizers, manufacture, developments in, 817.

slag, constitution and fertilizing value, 323.

slag, fertilizing value, 122, 723.

(See also Phosphates, comparison.)

## Phosphoric acid—

assimilation, factors affecting, 423.

availability, 619; Hawaii, 217.

available in soils, determination, 118.

determination, value, Hawaii, 217.

fertilization, 817.

fertilization, history, 424.

fertilization, summary, 218.

in blood, forms, 772.

increasing availability, 818.

insoluble, in superphosphates, 712.

manufacture, volatilization process, U.S.D.A., 521.

production, 818.

question, critical discussion, 218.

- Phosphoric oxid—  
citric soluble, determination in basic slag, 412.  
determination, sulphate-molybdate method, 412.
- Phosphorus—  
adsorbed, availability, 213.  
concentration in blood, effect of sunlight, 63.  
content of soils, 321.  
determination, 196.  
determination in organic material, 612.  
effect on alfalfa, 726.  
effect on meadows, 434.  
in human milk, racial variations, 562.  
inorganic, in milk, 609.  
metabolism, effect of cellulose and protein, 571.  
metabolism, effect of cod liver oil, 262, 570.  
metabolism in avitaminosis, 862.  
metabolism in rickets, 669.  
organic, analysis, 720.
- Photocatalyses, studies, 525.
- Phthalates, test for, 507.
- Phthorimaea glochinella*, studies, 847.
- Phyllosticta*—  
*nicotiana*, notes, 749.  
*solitaria*, notes, 750.
- Phymatotrichum omnivorum*, notes, Tex., 45.
- Physalis longifolia*, notes, 648.
- Physalospora*—  
*cydoniae*, notes, 449.  
*perseae* n.sp., description, 354.
- Phytomyza platensis* on salvia, 661.
- Phytomyzophaga albipes* n.g. and n.sp., description, 661.
- Phytonomus*—  
*posticus*, chalcidoid parasite of, 260.  
*posticus*, notes, 151.  
spp., notes, N.Y.Cornell, 57.
- Phytopathological Service for France, 499.
- Phytopathology—  
colloid chemistry methods in, 426.  
Portuguese glossary, 345.
- Phytophthora*—  
*faberi* on coconut and cacao, 149.  
*infestans* on eggplant, 146.  
(See also Potato blight, late.)  
*nicotianae*, notes, 248.  
*palmivora*, notes, 553.
- Phytosterols, studies, N.Y.State, 408.
- Pig—  
houses, colony, drawings, 288.  
muscle, antineuritic value, 859.
- Pigeons, composition of flesh, 196.
- Pigments, red, in plants, formation, 224.  
(See also Anthocyan.)
- Pigs—  
abnormalities, 429.  
age and chemical development, 569.  
and pork production in Missouri, 174.  
breed tests, Can., 777.  
breeding and management, N.Dak., 67.  
breeding experiments, Can., 470.  
care and management, 174.
- Pigs—Continued.  
castration, U.S.D.A., 883.  
cost of raising, Can., 272.  
crossbred, comparison, Can., 776.  
crossbreeding, Can., 369.  
effect of ventilation and light, 266.  
fall v. spring litters, 777.  
feed cost, Can., 868.  
feed requirements, 673, 777.  
feeding by method of equivalent feeds, 471.  
feeding experiment, indoor v. outdoor, 371.  
feeding experiments, 173, 372, 471, 870; Can., 470, 776; Kans., 67; Minn., 169; Miss., 68; Mont., 171; Ohio., 171; Pa., 469; S.C., 672; Tex., 70; Wyo., 371.  
(See also Sows, brood.)  
feeding, fundamental principles, 575.  
feeding on pasture, Ill., 673.  
growth curves, Mo., 467.  
inheritance in, 128.  
iron deficiency in diet, 172.  
orphan, methods of feeding, Iowa, 172.  
potatoes for, 574.  
purebred v. crossbred, Can., 470.  
raising, manual, 869.  
raising, suggestions for club members, 496.  
self-feeders for, 272; Tex., 71.  
surface area, determination, 268.  
winter housing, Can., 370.  
young, losses, cause, 878.  
(See also Sows and Swine.)
- Piles in clay, experiments, 86.
- Pile-set gauges, data, 88.
- Pili nut oil, composition, 309.
- Pine—  
bark aphid, natural control, 844.  
blister rust. (See White pine blister rust.)  
cone rusts, cronartial stage, 753.  
jack, methoxyl in, 206.  
leaf miner, notes, 151.  
loblolly, recovery and growth after suppression, 444.  
native, S.C., 647.  
Norway, current growth in, 544.  
Parana, lumber industry in Brazil, 40.  
plantations, Scotch, in Sweden, source of seed, 837.  
reproduction and high lead logging, 646.  
sawfly, imported, U.S.D.A., 458.  
seedlings, western yellow, frost heaving, 142.  
southern yellow, handbook, 587.  
species, comparative value, 544.  
white. (See White pine.)  
yellow, susceptibility to fire injury, 544.
- Pink—  
bollworm. (See Cotton bollworm, pink.)  
disease, distribution in Federated Malay States, 251.



*Pinus longifolia*, resin-tapping industry in, 40.  
 Pipe, concrete, reinforced, design, 86.  
 Pipes and valves, loss of head in, 483.  
 Pipette for lactose determination in milk, 714.  
 Pirquet feeding system, essential features, 360.  
 Pisé de terre, construction, 88.  
*Pissodes strobi* on white pine, 57.  
 Pistache trees, value in Arizona, U.S.D.A., 138.  
 Pita floja fiber, commercial status, 829.  
 Pituitary—  
   feeding, effect on egg production, 275.  
   feeding, effect on growth and gonad development, 366.  
*Placosphaeria nicotianae* n.sp., notes, 248.  
*Plagionotus speciosus*, notes, Conn.State, 50.  
 Plant—  
   biochemistry, textbook, 626.  
   biology, elements, treatise, 626.  
   breeding at Gross Enzersdorf, 28.  
     (See also special crops.)  
   cancers, studies, 745.  
   cell cytoplasm, elements in, 125.  
   cells, action of pressure on, 23.  
   cells, chemistry, treatise, 427.  
   cells, microsomes in, 23.  
   cells, structure, 427.  
     (See also Cells.)  
   chromosomes. (See Chromosomes.)  
   development and soil reaction, 532.  
   diseases—  
     and pests, Calif., 838.  
     and pests in Dutch East Indies, 548.  
     dissemination by seed, 745.  
     in France, 345.  
     in western Quebec, 345.  
     light treatment for, 345.  
     notes, S.C., 647.  
     relation to temperature, 41.  
     research in Bombay, 243.  
     resistance to, biochemistry, Minn., 146.  
     (See also Fungi and different host plants.)  
   distribution, effect of soil acidity, 420.  
   food, mineral, availability, 21.  
   growth—  
     and climate, relation, 807.  
     as affected by seed weight, 821.  
     as affected by temperature, 821.  
     curvilinear, 127.  
     effect of pH of nutritive solution, 627.  
     factors, law governing, 532.  
     in artificial light, Minn., 126.  
     in media poor in oxygen, 327.  
     in sand and solution cultures, comparison, 813.  
   inspection. (See Nursery inspection.)  
   lice and light exposure, 845.  
   louse killed by nicotin gas, laboratory study, 254.

## Plant—Continued.

  metabolism and growth, studies, Minn., 125.  
   nutrient material in soil, estimation, 118.  
   nutrient materials, sources, 322.  
   nutrients, adsorption, 16.  
   nutrients, availability, 17.  
   nutrients in soil, effect of adsorption on, estimation, 203.  
   pests and parasites, booklet, 545.  
   pigmentation. (See Pigments.)  
   products as chemical raw material, 608.  
   protection, bibliography, 142.  
   roots and stems, inverse orientation in, causes, 128.  
   roots, modifications by mechanical action, 23.  
   sap studies, 524.  
   stems, modifications by mechanical action, 23.  
   stems, orientation, 225.  
   tissue, effect on bacterial nutrition, 184, 879.  
   tissue fluids, properties, Minn., 125.  
   tissue, new hormone in, 108, 765.  
   tissues, effect of feeding punctures of aphids, Pa., 557.  
 Plants—  
   as affected by lead salts, 221.  
   as affected by low temperature, Minn., 125.  
   chemical system, effect of salts, Calif., 221.  
   colors in, 728.  
   conducting apparatus, acceleration of development, 225.  
   cultivated, vegetable parasites, 244.  
   fiber. (See Fiber.)  
   floral anatomy at various altitudes, 324.  
   forcing, treatise, 834.  
   greenhouse, insects affecting, U.S.D.A., 845.  
   grown in salt water, anomalies in, 428.  
   house, care, Kans., 141.  
   house, treatise, 543.  
   immunity reactions in, 345.  
   imports, U.S.D.A., 225, 428.  
   iron in, studies, 128.  
   manganese in, 21, 221.  
   medicinal. (See Drug plants.)  
   milk tainting, 878.  
   naturalization, 526.  
   nematode parasitic on, 452.  
   ornamental, treatise, 39.  
   photocatalysis in, studies, 525.  
   poisonous to livestock, 78.  
     (See also Livestock poisoning and specific plants.)  
   rainfall interception by, 315.  
   resistant to root-knot nematode, Ga., 553.  
   respiration. (See Respiration.)  
   selective action, 524.

- Plants—Continued.  
 transpiration. (See Transpiration.)  
 virus diseases, 244.  
 Plasma, colloidal constituents, action of salts on, 426.  
*Plasmodiophora vascularum*, notes, 351.  
*Plasmopara viticola*—  
   outbreaks in Italy, 149.  
   spore germination in, 249.  
 Plasticity, methods for measuring, 417.  
 Plastids, parasitism and resistance, 244.  
*Plathypena scabra* on soy bean, 256.  
*Platygaster*—  
   *hiemalis*, twinning and monembryonic development, 158.  
   *vernalis*, parasite of Hessian fly, 58.  
*Pleospora nicotianae* n.sp., notes, 248.  
*Plodia interpunctella*, parasite of, 663.  
 Plowing, fall v. spring, West.Wash., 195.  
 Plum—  
   brown rot, relative resistance to, 47.  
   curculio on peach, control, 453;  
     U.S.D.A., 662.  
 Plums—  
   breeding, Minn., 140; Can., 36.  
   composition as affected by *Sclerotinia cinerea*, 47.  
   culture experiments in Arizona,  
     U.S.D.A., 138.  
   hardiness, testing by freezing points,  
     Minn., 125.  
   rotted by *Sclerotinia*, analysis, 48.  
   *Sclerotinia* affecting, Minn., 148.  
   stock experiments, N.Y.State, 539.  
   thinning tests, Can., 340.  
   varieties, Mont., 139.  
   variety tests, Can., 440; Mont., 139.  
*Plutella maculipennis*. (See Diamond-back moth.)  
 Pneumatic tires, fabric stresses in, 486.  
 Pneumococcus—  
   cultures, peroxid in, 787.  
   growth, effect of plant tissue, 184.  
 Pneumonia—  
   progressive, in sheep, 481; Mont., 182.  
   purulent, in calves, 878.  
   specific infectious, of foals, 685.  
*Podosphaera leucotricha*, notes, 750.  
 Poison—  
   bran mash, formulas, Colo., 52.  
   ivy, monographic account, 181.  
 Poisonous plants. (See Plants, poisonous.)  
 Pollack liver oil, potency of, 665.  
*Pollinia fulva*, analyses, 168.  
 Polyneuritis—  
   blood of pigeons in, 860.  
   changes in glands during, 265.  
   (See also Vitamin B.)  
 Polypeptids, titration applied to, 802.  
*Polyporus lignosus*, notes, 42.  
*Polystoma algarum*, life history and habits,  
   850.  
 Pomegranates, varieties for Arizona, U.S.  
   D.A., 138.
- Pop corn, popping conditions, N.Y.State,  
 535.  
*Popillia japonica*, control, N.J., 56.  
 Poplar canker, notes, 754.  
*Porcellio laevis*, notes, 255.  
 Pork—  
   antineuritic value, 859.  
   killing, cutting, and curing, 272.  
   production in Missouri, 174.  
   (See also Pigs.)  
   products, commercial outlook, 594.  
*Poronidulus conchifer*, notes, 656.  
*Porosagrotis orthogonia*—  
   distribution, 846.  
   notes, 151.  
   studies, Mont., 155.  
*Porthetria dispar*. (See Gipsy moth.)  
 Porto Rico Station—  
   notes, 196, 398.  
   report, 597.  
 Pot—  
   culture experiments, 819.  
   experiments, earthenware jars as  
     source of error in, 617.  
 Potash—  
   active, in soils, effect of cropping, 118.  
   and magnesia fertilization, 724.  
   available in soils, determination, 118,  
     412.  
   effect on availability of phosphoric  
     acid, 818.  
   effect on cotton wilt, 45.  
   fertilizing value, Minn., 121.  
   from kelp., U.S.D.A., 424.  
   from leucite, 324.  
   from seaweed in California, 123.  
   in mixed fertilizers, determination,  
     412.  
   industry, Alsatian, 324.  
   production in United States, 727.  
   recovery from waste molasses, 324.  
   treatise, 724.  
 Potash-bearing minerals in Norway, 521.  
 Potassium—  
   chlorid and sulphate, comparison, 624.  
   chlorid, effect on soils, 621.  
   cyanid, use against pocket gophers,  
     Minn., 153.  
   cyanid v. hydrocyanic acid, 151.  
   effect on grapes and wine quality, 644.  
   effect on meadows, 434.  
   effect on potatoes, 235.  
   fertilizers, comparison, 818.  
   fertilizers, effect on ammonification  
     and nitrification, 818.  
   in blood plasma, determination, 615.  
   in human milk, racial variations, 562.  
   iodid for goiter prevention, Can., 371.  
   of orthoclase, availability, 19.  
   perchlorate method of determination,  
     507.  
   permanganate for grape *Oidium* con-  
     trol, 451.  
   salts, effect on orange trees, Calif., 327.  
   sulphate and chlorid, comparison, 624.  
   sulphate, effect on soils, 621.



## Potato—

- Association of America, proceedings, 398.
- beetle, Colorado, life history and control, 661.
- beetle, Colorado, studies, 758.
- black rot, cause, 243.
- black wart, biology, 550.
- blight, late, and weather, N.J., 47.
- blight, late, effect of temperature, 41.
- blight, late, immunity to, 350.
- blight, late, in Delaware, 546.
- blight, late, notes, 550.
- brown rot, description, U.S.D.A., 46.
- canker, notes, 46.
- degeneration diseases, studies, 46.
- diseases, 248, 550; Fla., 654.
- diseases, collected leaflets, 550.
- diseases in France, control, 447.
- diseases in India, 147.
- diseases in Kansas, control, 550.
- diseases in South Africa, 550.
- diseases, studies, Minn., 143.
- dry rot, notes, 147.
- Fusarium blights in India, 247.
- Fusarium diseases, studies, Mont., 143.
- heat rot or blackheart, chemical study, 147.
- hopperburn, control, Ohio, 448.
- industry, relation of science to, 398.
- insects, studies, N.Y.State, 555.
- leaf curl demonstrations, 350.
- leaf roll, control, N.Y.State, 546.
- leaf roll, correlation with tuber and sprout characteristics, 147.
- leaf roll in Ireland, 448.
- leaf roll, testing seed for, 652.
- leafhopper, bionomics and control, Iowa, 154.
- leafhopper, control, Minn., 152.
- leafhopper, injury from, 653.
- leafhopper, life history and control, 755.
- leafhopper, relation to hopperburn, Ohio, 448.
- leak, notes, 652.
- mosaic, control, N.Y.State, 546.
- mosaic in Ireland, 448.
- mosaic, testing seed for, 652.
- mosaic virus, time and temperature of killing, 652.
- mottling disease, correlation with tuber and sprout characteristics, 147.
- plant juices, osmotic pressure, 628.
- Rhizoctonia blight, notes, 147.
- ring disease, notes, 147.
- root knot, control, Fla., 652.
- scab, control, 653.
- scab, notes, 147.
- skin spot and powdery scab, 653.
- sorting machines, tests, 687.
- spindle tuber, Me., 350.
- spraying demonstration areas, 153.
- storage rots, studies, 243.
- streak, transmission, 653.
- synonym committee, report, 336.

## Potato—Continued.

- tambora disease control, 243.
  - tipburn, in Maine, 653.
  - tuber diseases, control, U.S.D.A., 840.
  - tubers, composition, Minn., 135.
  - tubers, Verticillium rot of, 449.
  - wart disease, studies, 653.
  - wart, varietal resistance, Pa., 445.
  - wilt, cause, 243.
  - yellow dwarf in New York, 653.
  - yellow dwarf, notes, 749.
- Potatoes—
- as affected by sulphur, Oreg., 724.
  - assimilation of nutrients, relation to soil fertility, 17.
  - breeding experiments, S.C., 637.
  - certified and noncertified, comparison, 637.
  - comparative studies, 234.
  - cost of production, Can., 592.
  - cost of production in France, 191.
  - culture, 550.
  - culture experiments, Minn., 133.
  - culture in Kansas, 533.
  - culture in western India, 247.
  - decline in yielding power, Mont., 135.
  - degeneration in, 247, 345, 350.
  - electroculture experiments, 131.
  - feeding value, 574.
  - fertilizing experiments, 235, 423, 637; Can., 533, 817; West.Wash., 520.
  - germination, fertilizer injury to, N.J., 216.
  - Green Mountain, correlation of characters, 633.
  - insects affecting, Fla., 659.
  - insulin in, 767.
  - irrigation experiments, Utah, 135.
  - maturity and yield trials, 336.
  - organic nitrogen for, S.C., 637.
  - prices, Minn., 193.
  - rate of manuring tests, Minn., 120.
  - rest period, relation to available nitrogen, 326.
  - rotation experiments, N.Y.State, 422.
  - seed, certified, Conn.Storrs, 32; S.C. 536.
  - seed importation, 46.
  - seed, new, treatment, 536.
  - seed, production, Nebr., 335.
  - seed, studies, Pa., 432.
  - seed, testing for mosaic, 652.
  - seed, treatment, 654; Minn., 143.
  - seeding experiments, Can., 533.
  - sources of potash for, 818.
  - spraying, N.J., 47; U.S.D.A., 32.
  - spraying and dusting, Mass., 654.
  - spraying experiments, 350; Ohio, 448.
  - standard grade, Mich., 437.
  - starch determination in, 313.
  - storage, 147.
  - tuber and sprout variation, relation to disease, 652.
  - varieties, characteristics, 237.
  - varieties for seed in Poland, 439.
  - varieties, identification, 831.
  - varieties, response to fertilizers, 234.

**Potatoes—Continued.**

variety tests, Can., 533; Minn., 133.  
water requirements, 828.  
yields, estimating, 737.

**Poultry—**

breeding records, Kans., 174.  
breeding stock, selecting, Mo., 873.  
breeds, characteristics, 275.  
Congress, World's, notes, 900.  
craft, treatise, 576.  
culling, directions, Mo., 872.  
demonstration farm, Mo., 890.  
diseases in Netherlands, treatment, 82.  
diseases, relation to vitamins, N.J., 383.  
diseases, summary, Nebr., 185.  
(See also *specific diseases*.)  
dressing and edible percentages, 473.  
egg-laying qualities, effect of breeding, 600.  
experiments, Can., 272, 273, 372, 777, 778.  
experiments, standardization, 576.  
farming in New Jersey, N.J., 90.  
feed, estimation of grit in, Mich., 715.  
feeding, commercial v. home mixture, Can., 471.  
feeding experiments, 871.  
feeding with red ant pupae, 576.  
(See also *Chicks and Hens*, laying.)  
feeds, digestibility, N.C., 274.  
houses, construction, 486; Oreg., 486.  
houses, fool-proof, Mo., 888.  
houses, open-air, Oreg., 888.  
houses, Oregon Agricultural College portable colony, Oreg., 590.  
houses, ventilation, 689.  
houses, wet litter in, 780.  
inheritance in, 128.  
inheritance of spangling in, 528.  
judging for egg production, 373.  
large and small breeds, cause, 429.  
lethal gene in, 731.  
longevity and constitutional vigor, 872.  
marketing, U.S.D.A., 873.  
plant, organizing, N.J., 73.  
production in Florida, 375.  
products, marketing, cooperation in, 294.  
raising, manual, 676, 779.  
ranch, planning, West.Wash., 175.  
rate of growth, Mo., 467.  
rate of senescence and decline of egg production, 577.  
rations for crate fattening, 373.  
scoring exhibits in, 195.  
selecting breeding males for egg production, Mass., 72.  
short course, methods of teaching, 195.  
systems of mating, Can., 471.  
transmission of hog cholera by, 382.  
vitamin deficiency in, 871.  
weights, coefficient of variability, 872.

**Poultry—Continued.**

weights, relation to weight and number of eggs, W.Va., 675.  
(See also *Chickens, Ducks, Fowls, etc.*)  
Poultrymen, daily schedule for, West. Wash., 175.  
Prairies, chemical fertilizers on, 322.  
Precipitation. (See *Rainfall and Snow*.)  
Pregnancy and lactation, effect of vitamin deficiency, 566.  
Preisz-Nocard bacillus as cause of lymphangitis, 81.  
Pressure, action on plant cells, 23.  
Prickly pear. (See *Cactus*.)  
*Prodecatoma phytophaga* in grape seeds, 851.  
Producer gas as engine fuel, 588.  
Prolamin of wheat bran, analyses, 711.  
Propionic—  
acid production from lactose, 109.  
fermentation of lactose, 109, 205.  
Proso millet stripe disease, 550.  
*Prospaltella berleset*, parasitism, 459.  
Protein—  
and pellagra, discussion, 164.  
animal, for egg production, Mont., 871.  
effect on inorganic metabolism, 571.  
effect on insulin requirement in diabetes, 766.  
supplements for pigs, Miss., 69; Pa., 469; Tex., 71.  
Proteins—  
ammonia nitrogen determination in, 713.  
differentiation, 204.  
digestibility studies, 360.  
feeding stuffs, quality, 775.  
of almonds, biological value, 857.  
of flour, imbibitional properties as affected by acids, 503.  
of walnuts, 462.  
of wheat bran, analyses, 711.  
quality and quantity in diet, 266.  
small amounts, nephelometric determination, 713.  
Proteinuria in newborn calves, cause, 883.  
Protomycetaceae, development and biology, 630.  
Protoparce—  
spp., disease of, 845.  
spp., notes, V.I., 555.  
Protoplasm, studies, 525.  
Protozoa—  
and Brazilian soils, 517.  
in South African soils, 518.  
Prune root borer, control, Oreg., 53.  
Prunes, culture experiments, Mont., 139.  
*Pseudaonidia tessera*, notes, V.I., 555.  
*Pseudococcus*—  
*citri*. (See *Citrus mealy bug*.)  
*longispinus*, summary, Mich., 454.  
*Pseudomonas*—  
*alboprecipitans* n.sp., description, 349.  
*campestris*, notes, 353.  
*cerasus*, notes, 751.



- Pseudomonas*—Continued.  
*juglandis*, studies, 753.  
*savastanoi*, pathogenicity, 752.
- Pseudoperonospora cubensis* on *Trichosanthes dioica*, 148.
- Pseudopeziza medicaginis*, notes, 447.
- Psyllia mali*, morphology and synonymy, 844.
- Puccinia*—  
*allii*, notes, 143.  
*coronata*, infection capabilities, 548.  
*coronata* spores, germination, 746.  
*dispersa*, notes, 648.  
*dispersa*, resistance of rye to, 129.  
*glumarum*, specialized varieties, 244.  
*glumarum tritici*, specialized forms, 245.  
*graminis tritici*, inheritance of resistance to, 634, 635.  
*graminis tritici*, III and IX, Nebr., 446.  
*graminis tritici*, III and XIX, cytological studies, 839.  
*hellanthi*, studies, 655; Minn., 654.  
*malvacearum*, studies, 150, 250.  
*sorghi*, studies, 747.  
*spp.*, notes, 548.
- Pulex irritans*, notes, 55.
- Pullets—  
crate feeding, effect, Can., 779.  
early v. late hatched, Can., 275.  
(See also Chickens and Hens.)
- Pulp. (See Paper pulp.)
- Pulpwood—  
and wood pulp in North America, treatise, 545.  
consumption, statistics, U.S.D.A., 41.
- Pulse rate of fowls, 82.
- Pumpkin leaves, temperature, 425.
- Purdue—  
Station, notes, 697.  
University, notes, 599, 697.
- Purin metabolism, 664.
- Purnell Bill, 895.
- Purpurea hemorrhagica* in horses, formaldehyde treatment, 482.
- Pyogenic infections, immunization, oral route for, 478.
- Pyrausta nubilalis*. (See Corn borer, European.)
- Pyrite, effect on sulphate leachings, 523.
- Pyrophorus luminosus*, notes, 457.
- Pythium-like fungi on potato, 652.
- Quinces, culture experiments in Arizona, U.S.D.A., 138.
- Rabbits—  
age and chemical development, 569.  
breeding and management, 474.  
breeds, description, 275.  
offspring of two sires in one litter, 631.  
raising, 152.  
toxicity of carbon tetrachlorid for, 283.
- Rabies, notes, 582.
- Radiation—  
solar, and unusual winter weather, 314.  
solar, measurements, 209.  
solar, results of work, 509.  
with mercury vapor quartz lamp, effect on rats on deficient diet, 568.
- Radium—  
effect on seed germination, 325.  
use against plant diseases, 345.
- Ragi pollen, germination, 433.
- Railroad ties, western species for, 142.
- Rain—  
analyses, 716.  
effect on formaldehyde treatment of onion smut, 748.
- Rainfall—  
and run-off, 586.  
distribution in Brazil, 415.  
effect on clover yields, 334.  
estimates, aeral, accuracy, U.S.D.A., 114.  
group distribution and periodicity, U.S.D.A., 415.  
interception by plants, 315.  
map of Africa, 14.  
map of Australia, 616.  
of Chile, 13.  
of Virgin Islands, V.I., 511.  
relation to cotton, 415.
- Raisins, vitamins in, Pa., 463.
- Rancidity, studies, 609.
- Range—  
and pasture management, 167.  
management, 867.
- Rape—  
as affected by sulphur, Oreg., 724.  
pasture, value for pigs, Can., 371.
- Raspberries—  
culture, 543.  
varieties, Mont., 139.
- Raspberry—  
anthracnose, control, 751.  
beetle, notes, 51.  
blue stem, notes, 354.  
cane aphid, description, 454.  
crown gall, studies, 745.  
diseases, N.Y.State, 547.  
diseases and insect pests, control, West.Wash., 195.  
fruit worm, studies, Conn.State, 848.  
insects, notes, N.Y.State, 555.  
leaf curl and mosaic, 751.  
orange rust, studies, 149.
- Rat—  
mite attacking man, U.S.D.A., 159.  
roof, recessive black variety, 430.
- Rations, calculating, for milk production, 676.
- Rats—  
age and chemical development, 569.  
albino, changes in weights of organs, 173.  
antenatal feeding of parents, effect on offspring, 667.

## Rats—Continued.

- breeding for feeding experiments, 169.
- Old English, mutant of, 631.
- plague infected without visible lesions, 151.
- stock, ration for, 765.
- (See also Rodents.)

Reaper-thresher, combined, use in Canada, Can., 288.

## Reclamation—

- history and performance, 482.
- of arid soils, 420.
- projects, extension of construction charges, 385.
- Service, report, 483.

*Recurvaria*—

- nanella*, notes, 554.
- piceaella*, notes, 151.
- pinella*, notes, 151.

## Red—

- bug, control, 660.
- mite, European, control, Conn.State, 50.
- mite, European, studies, Conn.State, 851.
- spider, control, 844.
- spider mites, new, in Connecticut, Conn.State, 50.
- spider, notes, 255.

## Redtop—

- breeding experiments, Can., 433.
- duration in meadows, N.Y.Cornell, 231.

Redwood and Douglas fir, fire resistance, 40.

Redwoods, bark, relation to diameter and volume, 744.

Refrigerator for shipping live insects, 657.

Rehmsdorf organic fertilizer, fertilizing value, 623.

Relapsing fever, relation to bedbugs, 53.

Reports, preparation, treatise, 898.

## Reproduction—

- effect of vitamin A deficiency, 60.
- unrecognized dietary factor essential for, 261.

Reproductive organs, internal secretions of, 366.

Research, agricultural. (See Agricultural research.)

Reservoirs, small storage, construction, 86.

## Respiration—

- of apples in storage, 542.
- of leaves in vacuum or in scant oxygen, 126.
- of roots, 627.

*Rhagoletis pomonella*, notes, 353.

*Rhamnus* spp., rôle in crown rust dissemination, U.S.D.A., 43.

Rhenania nitrogen phosphate and ammonium superphosphate, comparison, 817.

*Rhinocladium corticolum* on mango, 150.

*Rhipicephalus bursa*, notes, 882.

*Rhizoctonia*—

- solani*, immunity of potatoes to, 350.
- solani*, physiology, 43.

*Rhizoctonia*—Continued.

- sp. on lettuce, 651.
- spp., notes, 352.

*Rhizopus*—

- nigricans* on strawberries, 48.
- nigricans* spores, longevity, 630.
- nigricans* strains, variations in, 648.
- spp., H-ion changes induced by, 21.
- spp. on vegetables and fruits, 749.
- tritici* on sweet potato, acid production by, 21.

Rhodes grass, culture experiments, U.S.D.A., 132.

Rhododendron borer, notes, Conn.State, 50.

*Rhopalopsyllus* spp., notes, 55.

*Rhopalosiphum persicae*, notes, 156.

*Rhopobota naevana*, control, Mass., 659.

Rhubarb crown rot, summary, Pa., 445.

*Rhynchitis tristis*, papers on, 256.

Ribes as affected by *Cronartium ribicola*, 656.

## Rice—

- borer, studies, 756.
- bran adulteration, Mich., 714.
- bran proteins, nutritive value, 267.
- breeding experiments, P.R., 533.
- brown spots on glumes, P.R., 547.
- correlation among pure lines, 430.
- culture, 32.
- culture by the Chinese, 235.
- culture experiments, 28.
- detection in feeds, 468.
- effects of fertilizers, P.R., 550.
- fertilizer experiments, 28.
- flowers, sterility in, cause, 23.
- fly control, 455.
- Growers' Association, report, 793.
- helminthosporiose, studies, 246.
- improvement in Bengal, 828.
- insects affecting, 51, 153.
- insulin in, 767.
- milled, grades, U.S.D.A., 193.
- mutation and inheritance of semi-sterility in, 330.
- neuritis and beriberi, 668.
- parasitic fungi in relation to manures, 42.
- polish and tankage v. corn and tankage for pigs, Miss., 69.
- polishing, vitamin extraction from, 506.
- production in Malaya, 536.
- purple, inheritance of leaf color, 330.
- rough, grading and marketing, U.S.D.A., 193.
- sclerotial disease, notes, 243.
- seed selection tests, 28.
- seed, wild, studies, 338.
- sesame spot disease, 654.
- soils, decomposition of organic nitrogen in, 815.
- sterility in, P.R., 551.
- variety tests, 28, 828; S.C., 637.
- variety tests, probable error in, 536.



## Rice—Continued.

- weeds, root excretion, effect on rice, 832.
- weevil, biology, 255.
- wild, Minn., 160.

## Rickets—

- cause, rôle of parental nutrition, 165.
- effect on weight of organs of rats, 566.
- experimental, etiology and pathology, 63.
- experimental, studies, 670.
- in pigs, 266.
- in Vienna, studies, 567.
- phosphoric acid in blood in, 772.
- review of literature, 772.
- spontaneous, in rats, 165.
- ultraviolet ray therapy, 669.
- value of egg yolk in, 165, 166.

Riggs, W. M., biographical notes, 5.

## Rinderpest—

- immunization, oral route for, 478.
- virus, cultivation in vitro, 480.

Ring, effect on set of apples, 299.

## River—

- measurement. (*See* Stream.)
- sediment, content and value, 213.

## Road—

- grades, economics of, 886.
- laws of Kentucky, 587.
- materials of Kansas, 484.
- roughness, factor in pavement life, 886.

## Roads—

- construction in Peru, 887.
- construction, relation to highway research, 789.
- construction, treatise, 286.
- construction, use of marl in, 386. (*See also* Pavement.)

## Rock—

- for road building. (*See* Road materials.)
- phosphate. (*See* Phosphate.)

## Rodent pests—

- notes, 151.
- of Wyoming, summary, 151.

Rodents in orchards, control, 844.

(*See also* Mice and Rats.)

## Roentgen rays—

- effect on X-chromosomes, 226, 529.
- use against plant diseases, 345.

Roof rat, recessive black variety, 430.

## Root—

- and stalk rots, control, 546.
- crops, breeding experiments, Can., 433.
- crops, varieties, characteristics, 237.
- crops, variety tests, Mont., 134.
- knot, cause and control, U.S.D.A., 143.
- knot nematode, relation to fruit trees and grapevines, 451.
- knot nematode resistant plants, Ga., 553.

## Roots—

- absorption of carbon by, 628.
- corrosive action on marble, 221.
- elongation, 326.
- rest period, studies, Minn., 125.

## Roses—

- culture, 239, 645.
- culture experiments for Arizona, U.S. D.A., 138.

Rothamsted and agricultural science, 117.

## Roughages—

- for fattening steers, comparison, Can., 269.
- for lambs, Can., 271.

## Roundworms—

- control, 380.
- suckered, of poultry, control, 82.

## Roup—

- and canker experiments, 879.
- and colds in poultry, West.Wash., 185.

## Rubber—

- bark ring rot, notes, 49.
- brown bast and canker, corrective discussion, 49.
- brown bast, studies, 250.
- canker and brown bast, corrective discussion, 49.
- caoutchouc and latex vessels in leaves, 41.
- crêpe, mold, in, prevention, 452.
- diseases, 250.
- diseases and pests, 42.
- experiments, experimental error in, 242.
- leaf disease, South American, notes, 50.
- moldy rot, treatment, 49, 250.
- trees, transplanted, latex of, 647.

## Rural—

- child welfare, papers on, 194.
- church life in South, 494.
- church survey, Town and Country Series, 494, 794.
- community education, papers on, 893.
- community organization, Mont., 893.
- credit. (*See* Agricultural credit.)
- economics, experiment station research in, 101.
- economics in Japan, 892.
- economics, treatise, 891.
- education, 194.
- education in Oxfordshire, England, 93.
- education, treatise, 494.
- government, improvement, 92.
- labor. (*See* Agricultural labor.)
- leaders, professional training, 394.
- life, social aspects of, Iowa, 892.
- neighborhood as social unit, N.Y.-Cornell, 492.
- primary groups of Otsego Co., N.Y.-Cornell, 492.
- schools. (*See* Schools, rural.)
- sociology, value, 394.
- welfare work of Mexico, 694.
- (*See also* Community and Country.)

Rush stem disease in Japan, 248.

Rutabagas. (*See* Swedes.)

Rutgers College, notes, 698.

## Rye—

- breeding experiments, 28.
- certification in Germany, 439.

## Rye—Continued.

- culture experiments, Can., 231; U.S.D.A., 132.
- culture in the West, U.S.D.A., 639.
- feeding value, Can., 370.
- fertilizer experiments, 235, 423.
- from Volga region, composition, 169.
- Fusarium disease, studies, 245.
- grass, English, duration in meadows, N.Y.Cornell, 231.
- grass, western, breeding experiments, Can., 433.
- leaf rust resistance, 129, 648.
- seeding experiments, 235; Minn., 132.
- seedling blight, cause, 648.
- varieties, characteristics, 237.
- varieties for seed in Poland, 439.
- varieties, response to nitrogenous fertilizers, 232.
- variety tests, 136; Minn., 133; West. Wash., 134.
- winter, culture, N.Dak., 34.
- winter resistance, 231.
- Saccharids in plant tissues, effect of temperature, 21.
- Saccharomyces cerevisiae* growth in synthetic medium, 362.
- Saccharomycetes, studies, 426.
- Safflower seed, germination, 427.
- Sainfoin, winter habit, 333.
- Saissetia oleae*. (See Black scale.)
- Saliva, chemical constituents, 161.
- Salt—
  - effect on *Sterigmatocystis nigra*, 22.
  - mixed, fertilizing value, U.S.D.A., 621.
- Salts—
  - effect on reaction and buffer system of plants, Calif., 221.
  - effect on viscosity of flour-in-water suspensions, 504.
  - neutral, decomposition by humus, 514.
- Salvia leaf miner and parasites, 661.
- San José scale—
  - control, 153, 844; Conn.State, 50; Mo., 51; N.Y.State, 555.
  - on peach, control, 453.
- Sand and clay, apparatus for separating, 14.
- Sandy soils—
  - management, Minn., 120.
  - studies, Mich., 419.
- Sanninoidea—
  - cattiosa*. (See Peach borer.)
  - opalescens*, control, Oreg., 53.
- Santonin, ascaricidal value, 380.
- Sarcobatus vermiculatus*, notes, U.S.D.A., 77.
- Sarcophaga, larval characters in, 358.
- Sauerkraut manufacture, directions, West. Wash., 113.
- Scabies. (See Sheep scab.)
- Scale insects—
  - cage for rearing on plants, 151.
  - notes, V.I., 555.
  - of Florida, 155.
  - studies, Mo., 257.

- Schedonorus hookerianus*, analyses, 168.
- Schizaspidia tenuicornis*, life history, 459.
- Schizotetranychus schizopus*, notes, Conn. State, 50.
- Schoenobius incertellus*, studies, 756.
- School—
  - grounds, rural, planning, Mich., 442.
  - lunches, suggestions, 298.
  - of agriculture and viticulture in Dalmatia, 600.
- Schools—
  - agricultural. (See Agricultural schools.)
  - consolidated, teacher training for, 195.
  - consolidation, and transportation of pupils, 297.
  - in Texas, choice of subjects, relation to mentality, 296.
  - of agriculture, winter, in France, 597.
  - rural, consolidation, and transportation of pupils, 93.
  - rural, farm accounting in, 195.
  - rural, management, treatise, 596.
  - rural, pageant for, 95.
  - small holdings in Norway, teacher training, 94.
- Sciara militaris*, biology, 255.
- Science—
  - national temple of, editorial, 601.
  - remaking the world, treatise, 897.
- Sclerostomum renium* n.sp., description, 586.
- Sclerotinia—
  - apothecia*, relation to pH value, 451.
  - cinerea*, apothecia of, Md., 842.
  - cinerea*, control, Oreg., 842.
  - cinerea*, effect on plums, 47.
  - cinerea*, production of apothecia, 148.
  - fructigena*, studies, 552.
  - libertiana*, control, Mass., 651.
  - libertiana* in greenhouse, control, 549.
  - libertiana*, notes, 248, 655; Pa., 445.
  - libertiana* on figs, 751.
  - libertiana*, utilization of citric acid by, 630.
  - trifoliorum*, notes, 447; Ohio, 145.
- Sclerotium—
  - setosum*, notes, 547.
  - sp., notes, 547.
- Scolytus rugulosus*. (See Shot-hole borer.)
- Scrapie, effect of nutrition, 266.
- Scurvy—
  - experimental, changes in weight of organs, 465.
  - experimental, studies, 64.
  - production on vitamin C deficient diet, 166.
  - (See also Vitamin C.)
- Scymnus binacvatus*, introduction into California, 661.
- Sea sediment, content and value, 213.
- Sea water, effect on cement, 187.
- Sediment, value in plant nutrition and soil improvement, 212.
- Sedimentation cylinder, Sikorsky's, 14.



## Seed—

- analysis, methods, 338.
- certification and listing, N.Dak., 35.
- certification in Virginia, 641.
- grain, certification in Germany, 439.
- inspection in England and Wales, 338.
- inspection in Vermont, Vt., 338.
- inspection in Wisconsin, 338.
- laboratory, use, N.Dak., 439.
- law, Idaho, 35; N.Dak., 35.
- law of Canada, 539.
- production in Poland, 439.
- studies, Minn., 137.
- testing in Belgium, 833.
- testing in North Carolina, 833.
- testing, papers on, 237.
- tests, results, Idaho, 35.
- treatment, 546.
- values, biochemical tests, 222.

Seeding machines, tests, 687.

## Seeds—

- Act 1920, 237.
- agricultural, determination of origin, 237.
- appearance, relation to germinating and yielding capacity, 636.
- contributions to adult plant, 125.
- development, effect of lime, 325.
- direct contact of fertilizers with, effect, N.J., 215.
- effect on pH of solutions, 523.
- germinability, coloration as test, 325.
- germination, daylight, 34.
- germination, effect of pH of nutritive solution, 627.
- germination, effect of selenium and radium, 325.
- germination tests, status of methods, 238.
- germless, in corn, 528.
- imports, U.S.D.A., 225, 428.
- initial weight, effect on plant growth, 821.
- oil. (*See* Oil seeds.)
- papers on, 739.
- stimulation, 643.
- viability, determination, 507.
- weed. (*See* Weed seeds.)
- weight, effect on resulting crop, 636.

## Selenium—

- effect on plant development, 325.
- effect on seed germination, 325.

## Self-feeders—

- for calves, 579.
- for pigs, 272.

Septic tank and tile sewage disposal system, Mich., 289.

Septicemia, hemorrhagic, summary, 79.

Septoria diseases of cereals, 648.

## Septoria—

- lycopersici*, effect of fertilizers and lime, 47.
- paeoniae berolinensis*, notes, 355.
- petroselini apii*, control, 651.

Sericulture. (*See* Silkworms.)

## Serum—

- calcium determination in, 112.
- therapeutic and diagnostic, increasing yield, 583.

*Sesemia nonagrioides*, notes, 846.

## Sesia—

- acernt*, notes, Conn.State, 50.
- rhododendri*, notes, Conn.State, 50.

## Sewage—

- chemical changes and flora in, 888.
- digestion tanks, nitrogen formation in, 791.
- disposal plants for isolated dwellings, 190.
- disposal projects, 97.
- disposal system, tile, and septic tank, Mich., 289.
- examination, standard methods, 804.
- nitrogen recovery from, 124.
- purification by denitrification, 288.
- sludge as fertilizer, hygienic aspects, 791.
- sulphur content, 488.

## Sex—

- characters, development, 825.
- chromosomes of mammals, 825.
- determination mechanism, treatise, 530.
- determination, theory, 731.
- factors determining, 825.
- forms, distribution in phanerogamic flora, 431.
- ratios in *Drosophila*, 530.
- reversal and intersexuality, 825.
- reversal in fowls, 530.

Sexual cycle, mechanism, 635, 826.

## Sheep—

- botfly, human infection from, 259.
- breeding, Can., 371.
- breeding, management, and feeding, 369.
- early v. late shearing, Can., 469.
- feeding experiments, Ind., 369.
- (*See also* Ewes and Lambs.)
- growth curves, Mo., 467.
- inheritance of size and conformation, N.H., 26.
- ked, transmission of trypanosomes by, 357.
- multi-nippled and twin bearing, breeding, 331.
- parasite, free-living larval stages, 253.
- place on western Washington farms, West.Wash., 171.
- poisoning by greasewood, U.S.D.A., 77.
- (*See also* Livestock poisoning, Plants, poisonous, and *specific plants*.)
- scab, notes, 582.
- scab, occurrence in Great Britain, 182.
- trypanosome, studies, 357.
- wool yields, Can., 469.
- (*See also* Ewes and Lambs.)

Shingle nail experiments, Pa., 483.

Shingles, durability, Pa., 485.

Shot-hole borer in tea, control, 57.

Shrubs—

killing point, variation, Minn., 126.

wild, culture, 240.

Sikorsky sedimentation apparatus, 14.

Silage—

alfalfa, Italian method of ensiling, 468.

and alfalfa, feeding value, Ohio, 170.

clover v. sunflower for milk production, Can., 375.

composition and feeding value, 866.

corn, from early v. late maturing corn, Ohio, 175, 468.

corn, losses and exchanges of material during storage, Ohio, 572.

corn, state of maturity, Pa., 474.

corn v. sorghum, S.C., 679.

corn v. sunflower, for milk production, Can., 375.

corn v. sunflowers, Can., 432.

cost of production, Can., 592.

cutters, tests, 687.

maximum utilization for baby beef, Kans., 65.

microorganisms in, effects, Minn., 175.

nature of pigment in, 268.

sorghum v. corn, S.C., 679.

sunflower, composition, 267.

sunflower, feeding value, Can., 371.

sunflower v. clover, for milk production, Can., 375.

sunflower v. corn, Can., 432.

sunflower v. corn, for milk production, Can., 375; Mont., 176.

sunflower v. turnips for steers, Can., 468.

Silages, analyses, Oreg., 7.

Silicates, effect on wheat, 820.

Silicic acid, yield-increasing action, 425.

Silk, properties and uses, 534.

Silkworms—

diseases and treatment, 582.

inheritance of egg color in, 531.

Silos, pit, construction, 774; Colo., 388.

Sift behind old and new Austin dams, 286.

Silver leaf disease in South Africa, 353.

*Simulium columbaczense*, devastation by, 156.

Sires, Jersey, comparison, Mo., 874.

(See also Bulls.)

Sirups, solids in, determination, 202.

Sisal—

grading, baling, and inspection, 434.

pests affecting, 256.

properties and uses, 534.

Size factors and size inheritance, 823.

Skim milk—

feeding to chicks, effect on later egg production, W.Va., 72.

feeding value, Wash.Col., 277.

for calves, 579.

v. beef scrap for egg production, Can., 472.

vitamin A in, 59.

Skins and hides, 293.

Slime molds, North American, treatise, 727.

Sludge—

activated, fixation of atmospheric nitrogen by, 323.

activated, studies, 190.

(See also Sewage.)

Smith, G. A., biographical notes, 698.

Smoke screens, efficiency against frost, U.S.D.A., 115.

Smut—

on *Eleusine coracana*, experiments, 244.

spore germination, studies, 245.

(See also specific hosts.)

Snail poison, 553.

Snails—

distribution, factors limiting, 252.

white, affecting citrus, 657.

Snakeroot, white, poisonous to livestock, Ind., 181.

Snow, analyses, 716.

Soap, fat determination in, 614.

Sodamol, new agricultural explosive, Mich., 484.

Sodium—

carbonate, effect on moisture equivalent, 421.

carbonate, equilibrium studies, 813.

chlorid, effects on alfalfa, 625.

chlorid, use on meadows, 434.

(See also Salt.)

fluorid, poisoning by, 77.

in blood plasma, determination, 615.

nitrate, fertilizing value, 423, 424, 624.

nitrite, action in soil, 424.

salts, effect on intake of inorganic elements of plants, Calif., 221.

sulphate, effect on orange trees, Calif., 327.

Soil—

acidity, Mass., 621.

acidity—

cause, 318.

ecological factor, 513.

effect of crops and fertilizers, 18.

effect of sulphur, 123.

map of Long Island region, 717.

of Hawaiian soils, 619.

studies, 726, 814.

treatment, R.I., 17.

Truog test, modification, 203.

aeration, factors affecting, 318.

analysis, mechanical, apparatus, 809.

bacteria, counting, standardized medium for, 816.

bacteria, effect on nucleoproteid phosphorus, 720.

bacteriological studies, 720.

colloids, properties, 317.

cracks in Egyptian soils, rôle, 512.

dynamics, 98.

erosion, prevention in India, 718.



## Soil—Continued.

## fertility—

as affected by sulphur, Oreg., 724.  
index, 118, 517.

relation to assimilation of nutrients by crops, 17, 18.

studies, Minn., 120.

work at Rothamsted, 117.

gases, studies, 209.

improvement with white alder, 838.

moisture, control, Mo., 15.

moisture, effect on *Helminthosporium* infection of wheat, 649.

moisture equivalent, studies, 421.

moisture in walnut grove, seasonal changes in, Calif., 317.

nutrients, availability to plants, 619.

phosphorus, depletion, 321.

potting, fumigation, N.J., 56.

profile studies in Michigan, 617.

## reaction—

and plant development, 532.

factors affecting, 512.

litmus method for detecting, 619.

relation to calcium adsorption, 512.

studies, 618.

reclamation studies, 16.

samples, number required for chemical work, 213.

samples, pH value, effect of drying and storage, 718.

science, advances in, 716.

## solution—

importance in plant growth, 211.

methods of obtaining, 211.

osmotic pressure, 517.

volume, effect on plant growth, 212.

## survey in—

Alabama, Geneva Co., U.S.D.A., 617.

Alabama, Marengo Co., U.S.D.A., 319.

Arkansas, Perry Co., U.S.D.A., 519.

California, Brawley area, U.S.D.A., 519.

Georgia, Rockdale Co., U.S.D.A., 117.

Illinois, Livingston Co., Ill., 418.

Iowa, Dickinson Co., U.S.D.A., 519.

Iowa, Dubuque Co., U.S.D.A., 520.

Iowa, Hardin Co., U.S.D.A., 716.

Iowa, Woodbury Co., U.S.D.A., 617.

Michigan, Ontonagon Co., U.S.D.A., 319.

Missouri, Lafayette Co., U.S.D.A., 617.

Missouri, St. Louis Co., U.S.D.A., 419.

New Jersey, Chatsworth area, U.S.D.A., 319.

## Soil—Continued.

## survey in—continued.

North Carolina, Buncombe Co., U.S.D.A., 618.

North Carolina, Onslow Co., U.S.D.A., 419.

North Carolina, Tyrrell Co., U.S.D.A., 717.

southwestern Ontario, 717.

Utah, Ashley Valley, U.S.D.A., 814.

## temperature—

effect on corn seedling blight, 548.

effect on *Corticium vagum*, 348.

effect on *Helminthosporium* infection of wheat, 649.

effect on relation of roots to oxygen, 627.

measuring, 318.

studies, 718.

under a steam pan, 745.

toxins and bog xerophytes, 627.

type, determining, examination and comparison, 418.

type, effect on evaporation, 812.

ventilation, 719.

water ratio, 512.

## Soils—

acid, fate of superphosphate applied to, 218.

acid, H-ion concentration and active aluminum in, correlation, 220.

acid red, in Madhupur Jungle, 16.  
(See also Soil acidity.)

adsorbed bases in, estimating, 118.

adsorption phenomena in, 16.

alkali. (See Alkali.)

ammonification. (See Ammonification.)

analytical methods, 412.

arid, in the Punjab, properties, 420.

ash, of Germany, fertilizer requirements, 817.

bacteria in, estimation, 515.

bare and cultivated, evaporation from, 117.

classifying, auxotaxic curve in, 417.

clay content, relation to properties, 809.

colloidal material in, estimation, U. S.D.A., 811.

containing heavy minerals, mechanical analysis, 418.

evaporation of water from, 812.

flocculation, 810.

fungi in, activities, 620.

hardpan, studies, 14.

heavy, moisture equivalent, 421.

H-ion concentrations, 316.

humus determination in, 202.

in relation to forestry, Mich., 419.

loss of sulphates from, factors affecting, 521, 523.

modulus of rupture, index of structure, 809.

## Soils—Continued.

- muck. (See Muck soils.)
- nitrogen content. (See Ammonification, Nitrification, and Nitrogen.)
- of Africa, pH values, 420.
- of Assam, studies, 717.
- of Bengal, studies, 14.
- of Brazil, and protozoa, 517.
- of Darrang District, composition, 419.
- of Denmark, lime requirements, 724.
- of Egypt under flooding irrigation, 512.
- of England, 418.
- of Georgia, Floyd Co., analyses, 814.
- of Hawaii, acidity, nature of, 619.
- of Montana, analyses, Mont., 209.
- of Netherlands, manganese in, 514.
- of Otago Peninsula, analyses, 815.
- of Ozark region, studies, Mo., 15.
- of Quebec, pH values, 513.
- of Sheridan Co., physical survey, 209.
- of South Africa, protozoa in, 518.
- of Sudan, analyses, 316.
- of Sudan, nitrification, 816.
- of Sweden, types, 720.
- of Transvaal, analyses, 420.
- of Transvaal, nature of, 815.
- organic matter in. (See Organic matter.)
- oxygen-supplying power, determination, 22.
- peat. (See Peat.)
- phosphoric acid, determination in, 118.
- physical constants, 14.
- physical properties, relation to pH values, 618.
- potash determination in, 118.
- potash in, effect of cropping, 118.
- saline, reclamation in Punjab, 209.
- "sick," treatment, 521.
- specific surface, determination, 86.
- sterilization, partial, effect on microbiological activities, 620.
- subgrade, investigations, 790.
- water-holding capacity, 316.
- Solar radiation. (See Radiation.)
- Solids, determination by gauze dish method, 201.
- Solutions, reaction change due to seeds, 523.
- Solvents, water-miscible, for vitamin extraction, 506.
- Sore throat, septic, milk-borne epidemic of, 79.
- Sorghum—
  - and corn, relative water requirement, Kans., 28.
  - culture experiments in Sweden, 735.
  - inheritance of seed coat color, 431.
  - leaves, temperature, 425.
  - Phoma insidiosa* affecting, 148.
  - silage. (See Silage.)
  - tannin in, 615.
  - v. corn, feeding value, Tex., 66.
  - variety tests, U.S.D.A., 132.
  - (See also Milo.)

## Sorgo—

- Culture experiments in Sweden, 735.
- juice, starch in, 206.
- sirup, jellying, prevention, 509.
- tannin in, 615.
- variety tests, U.S.D.A., 132.
- South Carolina Station—
  - notes, 398.
  - report, 696.
- Sows—
  - brood, alfalfa v. Sudan grass for, Kans., 68.
  - brood, selection and management, 777.
  - brood, wintering, Can., 470.
  - (See also Pigs.)
- Soy bean—
  - hay, effect on milk production, W.Va., 73.
  - hay, feeding value, 271.
  - leaves, temperature, 425.
  - meal, feeding value, Can., 470.
  - oil, catalytic hydrogenation, 610.
  - oil meal, feeding value, Ohio, 171.
  - pod and stem blight, 840.
  - production, machinery for, 98.
  - proteins, nutritive value, 267.
- Soy beans—
  - and corn, feeding value, Miss., 70.
  - breeding experiments, P.R., 533.
  - detection in feeds, 468.
  - feeding value, Ill., 675; Ohio, 171.
  - germination, fertilizer injury to, N.J., 216.
  - improvement in Manchuria, 437.
  - inheritance in, 632.
  - insects affecting, Ohio, 256.
  - seeding experiments, Minn., 133.
  - v. cowpeas for pigs, 471.
  - varieties, Miss., 828.
  - variety tests, Minn., 133; S.C., 637; V.I., 533.
- Spalangia muscidarum*, notes, 359.
- Sparaganothis sulfureana*, life history notes, Mass., 659.
- Speltoid heterozygotes, spikelets on progeny of, 27.
- Spermatogenesis, marsupial, 329.
- Spermatozoa, head length dimorphism of, 730.
- Sphacelotheca*—
  - reiliana*, notes, 146.
  - spp., notes, 243.
- Sphaerostilbe cocophila* on grapefruit, 752.
- Sphecius speciosus*, habits, 359.
- Spherome in plant cells, nature, 223.
- Spicaria javanica* n.sp., description, 249.
- Spices—
  - analyses, Conn.State, 160.
  - effect on *Clostridium botulinum*, 366.
- Spider mite. (See Red spider mite.)
- Spiders, British, treatise, 260.
- Spinach—
  - antirachitic properties, 771.
  - culture, Ariz., 139.
  - dried, antiophthalmic vitamin in, 263.
  - fertilizer experiments, N.J., 36.



## Spinach—Continued.

- green peach aphid on, Pa., 453.
- growth-promoting and antirachitic values, 771.
- manuring experiments, R.I., 35.
- syrrhid larvae on, 156.
- variety tests, N.J., 36.

## Spirochetosis icterohemorrhagica, notes, 253.

## Spleen, insulin-like substance in, 864.

*Spongospora subterranea*, notes, 147, 550.*Sporotrichum carnis*, notes, 763.

## Spray practices in America, 844.

## Spraying—

- dormant, West.Wash., 598.
- dust. (See Dusting.)
- manual, 440.
- materials, combinations, reactions from, 346.
- papers on, 844.
- (See also Apples, Potatoes, etc.)

## Sprays—

- copper. (See Copper.)
- fungicidal properties, 346.
- lacking copper, failure, 446.
- preparation, Oreg., 834.
- (See also Insecticides, Fungicides, and specific forms.)

## Spruce—

- budworm outbreaks, 844.
- budworms, eastern, in the West, 756.
- gall aphid, notes, Conn.State, 50.
- insects affecting, 153.
- leaf miner, notes, 151.
- mite, life history notes, Conn.State, 50.
- stem girdle, control, 150.
- white, distribution and habits, 344.
- white, growth in Adirondacks, 646.
- wood, white, hydrolysis products, 8.

## Spurge nettle seeds, analyses, 610.

## Squabs, composition of flesh, 196.

## Squash ladybird beetle, Va., 759.

## Squashes, variety tests, Minn., 138.

## Squirrel-tail grass poisonous to livestock, 78.

## Staggers or shivers in livestock, 480.

## Stallion registration and licensing, Kans., 71.

## Standard of living in diversified farming section, N.Y.Cornell, 294.

## Starch—

- constitution, 505.
- content of sorgo juice, 206.
- determination, 312, 313.
- grains, size, relation to flour strength, 712.
- hydrolysis, effect on amino acids, 611.
- mobile, in plants, and geotropism, 127.
- storage in pear and apricot trees, 835.

## Starches, hemicellulose content, 310.

## Starvation—

- diets, effect, 562.
- insects, effect on offspring, 732.

## State Plant Culture Committee, Danish, report, 28.

## States Relations Service, final report of director, 3.

## Steers—

- effect of wintering on summer pasture gains, Kans., 65.
- feeding experiments, Can., 269, 368; Pa., 869; Tex., 775.
- growth curves, Mo., 466.
- metabolism experiments, 670.
- on pasture, effect of cottonseed meal, Miss., 65.
- (See also Cattle.)

## Stem rust, black, control, Wis., 649.

*Stemonites splendens*, notes, 42.*Stephanocleonus plumbeus*, notes, 259.*Stereum purpureum*, notes, 353.*Sterigmatocystis nigra*—

- acid fermentation, 328.
- effect of sodium chlorid, 22.
- toxicity of phenols for, 245.

## Sterility—

- diseases causing, 78.
- in cattle, pathology, 788.
- in rice flowers, cause, 23.
- in swine, 870.
- in wheat hybrids, Me., 26.
- pathology of, studies, Minn., 182.
- studies in fruit breeding, Minn., 130.

*Stigmus fulvicornis*, damage to floors by, 664.*Stilbum scabre* n.sp., notes, 42.

## Stock. (See Livestock.)

## Stock foods. (See Feeding stuffs.)

## Stockyards fever. (See Septicemia, hemorrhagic.)

## Stomata of Rubus, effect of orange rusts, 354.

## Stomatitis—

- contagious pustulous, in sheep, 585.
- in suckling pigs, 878.

## Stomoxys, effect of food on longevity and reproduction, 456.

## Stone for road building. (See Road materials.)

*Strategus titanus*, notes, V.I., 555.

## Straw—

- from Volga region, composition, 169.
- gas, experimental production, U.S.D.A., 387.

## Strawberries—

- breeding experiments, Alaska, 539; Vt., 342.
- culture, Ohio, 238.
- improved hardy, production, Alaska, 140.
- sterility, Vt., 342.
- varieties, Mich., 442; Minn., 138; Ohio, 238.
- variety tests, Can., 440.

## Strawberry—

- crown borer, studies, Tenn., 760.
- leaf roller, parasite of, 359.
- root weevil, notes, 259.
- rootworm on greenhouse rose, U.S. D.A., 55.
- rots in Florida and California, 48.

## Stream—

- discharge measurements, improvement, 685.
- flow in California, 84.

## Streptococci—

- content of souring milk, 279.
- dairy and pathogenic, relation, 878.
- of feces and mouth of cows, 377.

## Streptococcus—

- growth, effect of plant tissue, 184.
- infection, local immunity against, 78.

*Streptococcus*—

- bovis*, description, 377.
- lactis*, effect on keeping quality of butter, 476.
- paracitrovorus*, effect on keeping quality of butter, 476.
- paracitrovorus* in dairy products, Iowa, 179.
- spp., peroxid in cultures, 787.

*Strongylus*—

- contortus* infection in lambs, 878.
- tetracanthus*, pathogenic rôle, 81.

## Structures, framed, design and construction, treatise, 688.

## Stumpage on national forests, appraising, U.S.D.A., 141.

## Stuttgart's disease, notes, 253.

## Subsoil acidity, 619.

## Sucrose—

- alpha-naphthol test for, apparatus, 11.
- determination in presence of other sugars, 614.
- gum levan formation from, 410.

## Sudan grass—

- culture experiments in Sweden, 735.
- for pastures, 533.
- v. alfalfa, feeding value, Kans., 68.

## Sugar, apparatus for detecting, 11.

## Sugar beet—

- curly top, leafhopper as carrier, 660.
- leaf spot, control, 336.
- webworm, life history, 336.
- (See also Beet.)

## Sugar beets—

- comparative field experiments, 738.
- electroculture experiments, 131.
- fertilizer experiments, 423.
- improvement, 439.
- improvement in Spain, 832.
- irrigation experiments, Utah, 136.
- pictorial atlas, 235.
- premature seed formation, 832.
- seed production, 832.
- spacing experiments, 737.
- studies, 336.
- varieties, sugar in, 639.
- variety tests, Can., 432, 533; Minn., 133.

## Sugar cane—

- abnormal, in Australia, 833.
- assimilation of phosphoric acid by, Hawaii, 217.
- critical periods in growth, 336.
- culture, 637.
- culture experiments, 28.

## Sugar cane—Continued.

- cut, deterioration, 236.
- dry top rot, notes, 351.
- experimental work in Philippines, 236.
- experiments, 738.
- experiments in British Guiana, 640.
- fertilizer experiments, 28, 322.
- green manuring experiments, La., 33.
- grub, control, 848.
- gumming disease, notes, 351.
- hot-water treatment, U.S.D.A., 525.
- improvement in Bengal, 828.
- in Java, 640.
- in Philippines, breeding, 537.
- insects affecting, 153; V.I., 555.
- irrigation in Hawaii, 483.
- juice, clarification, 715.
- leaf spot, notes, 244.
- leafhopper, control, 356.
- mosaic. (See Sugar cane mottling disease.)
- moth borers in British Guiana, 155.
- mottling disease, nature, 351.
- mottling disease, notes, 551, 840.
- mottling disease, relation to manures, 42.
- root disease, studies, 351.
- root parasite, life history and control, 248.
- soils, effect of molasses, 820.
- Uba, in Porto Rico, 640.
- varieties, improvement, 833.
- varieties in Java, 32.
- varieties in Porto Rico, 738.
- variety tests, 28; V.I., 533.
- vitamin D in, 564.
- wrapping, 33.
- yellow stripe. (See Sugar cane mottling disease.)

## Sugar—

- caramelization, formic acid formation, 805.
- content of apples in storage, 542.
- in blood. (See Blood sugar.)
- industry, utilization of by-products, 715.
- juices, neutral clarification, 413, 615.
- mill laboratories, simplified tests in, 715.
- progress since 1912, 615.
- refining, limits of H-ion concentration in, 11.
- research institute in Czechoslovakia, 400.
- yields in Philippines, 795.

## Sugars—

- reducing, determination, 413.
- toxicity in avitaminosis, 164.
- (See also Glucose, Sucrose, etc.)

*Sulfomonas thiooxidans*, growth and respiration, 517.

## Sulphate—

- of ammonia. (See Ammonium sulphate.)
- of potash. (See Potassium sulphate.)
- Sulphates, loss from soil, factors affecting, 521, 523.



## Sulphur—

- and soil acidity, 123.
- compounds, determination in dry lime sulphur, 107.
- distribution in protein-free milk, 710.
- dust as insecticide, 844.
- effect on alfalfa, 726.
- effect on sulphate leachings, 523.
- fertilizing value, 220.
- for bunt control, Calif., 44.
- in biological material, determination, 612.
- in sewage, 488.
- mixtures. (*See* Lime-sulphur.)
- oxidation for improving alkali soils, 726.
- oxidation studies, 725.
- oxidizing bacteria, growth and respiration, 517.
- relation to soil fertility, Oreg., 724.
- significance to agriculture, N.J., 20.
- toxic property, 345.
- treatments, effect on soils, 725.
- use in potato scab control, 653.

Sun spots, relation to climate, 315.

## Sunflower—

- beetle, notes, 151.
- grafts, studies, 224.
- rust, biologic forms, Minn., 144.
- rust, studies, Minn., 654.
- silage. (*See* Silage.)
- wilt, studies, Mont., 143.

## Sunflowers—

- analyses, Oreg., 7.
- as affected by sulphur, Oreg., 724.
- breeding experiments, Can., 433.
- cost of production, Can., 592.
- endurance of high temperature by embryos, 325.
- for silage, variety tests, Can., 432.
- seeding experiments, Can., 533.
- variety tests, Can., 533; Mont., 133.

## Sunlight, effect on—

- rachitic changes in bones of children, 63.
- xerophthalmia, 61.

## Superphosphate—

- ammoniated, fertilizing value, U.S. D.A., 621.
- double, analysis, 196.
- effect on active aluminum, R.I., 17.
- fertilizing value, Minn., 120, 121.
- (*See also* Phosphates, comparison.)

- industry, use of raw materials, 424.
- treble, fertilizing value, Minn., 120.

## Superphosphates—

- insoluble phosphoric acid in, 712.
- reversion in acid soils, 218.

## Suprarenals—

- rôle in vitamin B deficiency, 859.
- transplantation into doves, effect, 826.

Swamp fever virus carrier, history, N.Dak., 80.

## Swedes—

- rotation experiments, R.I., 520.
- variety tests, Can., 432, 533; Minn., 133.

## Sweet clover—

- analyses, Oreg., 7.
- culture experiments, Alaska, 532; Minn., 133.
- damaged, disease due to, 878.
- on fall plant sugar cane, La., 33.

## Sweet corn—

- breeding experiments, P.R., 540.
- canned, quality in, 741.
- tests, Mont., 139.
- varieties, Can., 339; Mont., 139.
- (*See also* Corn.)

Sweet pea wilt, notes, 547.

## Sweet potato—

- diseases, 136, 551.
- stem rot, notes, 749.
- weevil, Tex., 759.

## Sweet potatoes—

- breeding experiments, S.C., 637.
- bud mutation in, V.I., 533.
- culture in Hawaii, Hawaii, 136.
- decaying, acids produced by, 21.
- harvest and storing, Ala., 337.
- maltose formation in, 711.
- shape, effect of fertilizers, 300.
- storage and marketing, 551.
- treatise, 136.
- varieties, Miss., 828.
- varieties, classification, 336.
- variety tests, 28; P.R., 533; U.S.D.A., 132; V.I., 533.

## Swine—

- posterior paralysis, 869.
- sterility and low fertility in, 870.
- (*See also* Pigs.)

Swiss Dairy Association, report, 781.

Symptomatic anthrax. (*See* Blackleg.)

*Synanthedon acerni*, notes, Conn.State, 50.

*Synchytrium endobioticum*, notes, 550.

Syrphid larvae on spinach, 156.

*Tabanus* spp., notes, 358.

Tachinidae, "biological species," 848.

*Taenia* spp. in frozen meat, 582.

Tafia, effect on nitrification in soil, 721.

## Tankage—

- amount for pigs, Can., 776.
- and corn, feeding value, Miss., 69.
- vitamin content, Ohio, 573.

Tanks, welded v. riveted, 888.

Tannin in plant tissue, estimation, 614.

Tapeworms, viability of larval forms, effect of cold, 582.

Taros, spacing experiments, P.R., 533.

## Tea—

- analyses, Conn.State, 160.
- culture and preparation, 39.
- importation and inspection, U.S.D.A., 10.
- mosquito blight, notes, 249.
- mosquito bug, control, 556.

## Tea—Continued.

- shot hole borer, summary, 454.
- studies, 836.
- vegetative propagation, 645.

Teachers, training for consolidated schools, 195.

Teak heart rot, notes, 354.

Teleost, viviparous, sex differentiation in, 331.

## Temperature—

- critical, for pear orchards, U.S.D.A., 807.

## effect on—

- bent wing mutation, 823.
- coniferous seedlings, 443.
- nitrification, 516.
- plant diseases, 41.
- plant growth, 821.
- testing cotton materials, 234.
- high, endurance by *Helianthus* embryos, 325.
- high, sensitivity of mitochondria to, 325.
- low, automatic control, 589.
- low, effect on blood sugar and ovulation, 868.
- low, effect on plants, Minn., 125.
- of leaves, 425.
- of Mexico, U.S.D.A., 116.
- on pavements, effect, 790.
- relation to cotton, 415.
- toleration by *Drosophila*, 729.
- water-surface, of Gulf of Mexico, effect on Texas weather, U.S.D.A., 115.
- (See also Climate and Soil temperature.)

*Tenebrioides mauritanicus*. (See Cadelle.)  
Tennessee University, notes, 196.

Tent caterpillar, forest, outbreaks, 844.

*Tenuipalpus lineola*, notes, Conn.State., 59.  
*Tephrosia candida*, effect of length of day, P.R., 533.

*Terminalia paniculata*, distribution and characters, 40.

## Termites—

- intestinal protozoa in, 256.
- of Canal Zone, studies, 659.

## Testes—

- of intersexual animals, histological study, 227.
- of rats, degeneration on milk diet, 867.

Tetanus resembling disease among cattle, 788.

*Tetranychus populi*, notes, Conn.State, 50.

*Tetrastichus*—

- giffardianus*, notes, 55.
- thripophonus*, new parasite of thrips, 159.

*Tetropium gabrieli*, summary, 848.

## Texas—

- College, notes, 699.
- Station, notes, 699.

## Textile—

- and clothing, teaching methods, 796.
- chemistry, treatise, 308.
- fabrics, treatise, 695.
- problems, newer ways with, 829.

Textiles and clothing, graduate work in, 297.

*Theileria hirci* n.sp., description, 882.

Theileriasis in goats and sheep, 882.

Therevidae, North American, revision, 848.

*Thielavia basicola*, notes, 248.

*Thlaspi alliaceum*, notes, 439.

Thomas slag. (See Phosphatic slag.)

Thresher-reaper, combined, use in Canada, Can., 288.

Threshers, wooden and all-steel, experiments, 88.

## Thrips—

- from Trinidad, parasite of, 159.
- injury to citrus fruits, 555.

Thumbs, hereditary shortness, 227.

*Thurberiphaga catalina*, notes, 660.

Thyme, culture and preparation of products, 140.

Thymectomized animals, prolongation of survival period in, 772.

Thymol, anthelmintic value, 380.

Thyroid and parathyroid removal, effects, 774.

Thyroparathyroidectomy in rabbits, 686.

Thysanoptera of North America, synopsis and catalogue, Fla., 660.

*Tibicina septendecim*. (See Cicada, periodical.)

Tick paralysis, summary, 762.

Tile, drainage. (See Drainage.)

Tillage machinery, tests, 687.

## Timber—

- drying, 485.
- green, poisoning, Mich., 445.
- softwood, supplies of United States, 837.
- structural, grading rules and working stresses, U.S.D.A., 187.
- western species for railroad ties, 142.
- (See also Lumber and Wood.)

Timbers, useful, of tropical America, 647.

## Timothy—

- and clover hay, rotation experiments, R.I., 520.
- breeding experiments, Can., 433.
- duration in meadows, N.Y.Cornell, 231.
- hay, fertilizer experiments, Can., 817.
- hay, yields, Can., 432.
- rate of manuring tests, Minn., 121.
- rust-resistant, Minn., 143.
- v. clover, rotation experiment, N.Y. State, 421.

*Tinca pellionella*, control, U.S.D.A., 53.

*Tineola biselliella*, control, U.S.D.A., 53.

*Tipula olcracea*, notes, 255.

## Titration—

- electrometric, application of benzoquinhydrone electrode, 507.
- of amino and carboxyl groups, 802.

Toadflax, bastard, parasitism of, 749.

## Tobacco—

- aboriginal species, 236.
- bacterial leaf spot, effect of temperature, 41.
- cigar, industry in Pennsylvania, 237.



## Tobacco—Continued.

- culture experiments, Can., 537; N.Y. State, 437.
- curing, Can., 537.
- curing barns, development, 97.
- Dell, types, 236.
- diseases in Brazil, 248.
- dust as contact insecticide, 557.
- electroculture experiments, 131.
- fertilizer experiments, 236, 237; Pa., 437.
- flea-beetle in cigar-wrapper district, U.S.D.A., 56.
- flea-beetle, notes, V.I., 555.
- flea-beetle, summary, U.S.D.A., 56.
- gummosis, studies, 347.
- hornworm, control, U.S.D.A., 53.
- industry in Cuba, 833.
- insects affecting, 51; V.I., 555.
- leaf spot disease, notes, 749.
- mosaic disease, effect of temperature, 41.
- mosaic disease, infective particles in, 840.
- production in Connecticut Valley, papers on, 137.
- rotation experiments, Can., 537.
- seed bed studies, Can., 537.
- seed, limiting number of flowers for, 640.
- soil, nutrient, and climatic requirements, 236.
- susceptibility to mosaic, 352.
- Turkish, culture, 33.
- Turkish, culture, curing, and marketing, Calif., 538.
- untreated, nicotin in leaf and smoke, 538.
- wildfire disease, notes, 749.

Toluene, effect on microbiological activities in soil, 620.

## Tomato—

- crown gall, studies, 42, 745.
- cuttings, root production in, 300.
- diseases, 148, 547.
- fruit rot, new, 551.
- leaf spot, effect of fertilizers and lime, 47.
- mosaic disease, 547.
- mosaic, overwintering, 655.
- root rot, notes, 547.
- seedlings, damping-off, control, 352.
- spotting, description, 749.
- stem rot, notes, 547.
- strains, determining constancy, 300.
- weevil, Australian, in the South, U.S.D.A., 57.
- wilt experiments, 551.
- winter blight or streak, 655.

## Tomatoes—

- breeding experiments, P.R., 540.
- effect of limestone, 300.
- fertilizer experiments, Can., 340.
- from home selected seed, Mont., 139.
- greenhouse, pollination, 300; Oreg., 834.
- keeping qualities in storage, 139.

## Tomatoes—Continued.

- overhead irrigation studies, Minn., 139.
  - production, Calif., 741.
  - pruning test, Can., 440.
  - strain selections, Minn., 139.
  - varieties, Pa., 439.
  - yield and time of ripening tests, Can., 339.
  - yield as affected by irrigation, Mo., 15.
- Torula botryoides*, notes, 763.
- Town—
- and country, service relations, Wis., 691.
  - v. country, treatise, 892.
- Tractor—
- farming in New Jersey, N.J., 90.
  - plant, heat treating processes, 388.
- Tractors—
- and tractor implements, demonstration, 287.
  - design and economy, 486.
  - general purpose, paper on, 98.
  - operating costs, N.J., 90.
  - selection and care, N.J., 90.
  - tendency to rise in front, Calif., 189.
  - tests in England, 189.
- Traffic dictionary, 593.
- Trametes persoonii*, notes, 42.
- Transpiration, effect of hardening of plants, 300.
- Transportation—
- and agriculture, 490.
  - problems in Iowa, 586.
  - systems of the United States, treatise, 88.
- Trees—
- ancestors, 240.
  - coniferous. (See Coniferous.)
  - evergreen, in Finland, 838.
  - feeding, independent of roots, 299, 834.
  - for Arizona, U.S.D.A., 138.
  - forest, insects affecting, 256.
  - forest, light requirements, Vt., 343.
  - forest, of District of Columbia, 241.
  - forest, of Georgia, 543.
  - forest, of Kentucky, manual, 543.
  - forest, of South Carolina, manual, 40.
  - forest, of Western Australia, 743.
  - forest, significance of 255-year class, 444.
  - in St. Thomas, fungus diseases, 42.
  - killing point, variation, Minn., 126.
  - of California, 744.
  - of Yellowstone National Park, 645.
  - planting in Canada, 344.
  - planting in national forests, 344.
  - pulping values, 142.
  - resetting, effect of orientation in, 225.
  - shade, insects affecting, 153.
- Trematodes, summary, 51.
- Trialeurodes inaequalis* n.sp., description, 556.
- Tribolium confusum*—
- notes, 51.
  - nutritional requirements, Minn., 152.

*Trichogramma minuta*, notes, Mass., 659.  
*Trichophaga tapetzella*. (See Carpet-moth.)  
*Trichosanthes dioica*, *Pseudoperonospora cubensis* on, 148.  
 Trimethylamin, cause of fishiness in butter, Wis., 279.  
*Trioza merwei*—  
   life history and habits, 257.  
   n.sp., description, 155.  
*Trombicula tlalzahuatl*, notes, 762.  
 Truck crop diseases, Minn., 143; Pa., 445.  
 Truck crops, insects affecting, V.I., 555.  
 True, A. C., appreciation, 895.  
*Trypanosoma*—  
   *melophagium*, studies, 357.  
   spp., action of Bayer 205 on, 184.  
   spp., control, 584.  
 Trypanosomiasis, control, 584.  
 Trypetidae, North American, revision, 457.  
 Tryptophan determination, 204.  
 Tubercle bacilli—  
   lipoids, biological properties, 584.  
   strains, 882.  
 Tuberculin—  
   comparative sensitiveness from dead or avirulent tubercle bacilli, 284.  
   reactions and dead bacilli, 381.  
   sensitiveness due to dead tubercle bacilli, 480.  
   standardization, 80.  
 Tuberculosis—  
   bovine, occurrence in Great Britain, 182.  
   complement fixation in, 584.  
   control, Calif., 788.  
   diagnosis, 584.  
   dish towel as source of infection, 381.  
   eradication, 81.  
   immunization, oral route for, 478.  
   immunological studies, 80.  
   in cattle, avian type, Wyo., 381.  
   in cattle, eradication, Alaska, 787.  
   in Denmark, discussion, 184.  
   treatise, 584.  
 Tuberization and tumefaction, 326.  
 Tumefaction and tuberization, 326.  
 Turkeys—  
   management, Mont., 73.  
   management in South Africa, 375.  
 Turnip—  
   aphid, control, Conn.State, 50.  
   bacterial disease, 352.  
   gall weevil, studies, 57.  
 Turnips—  
   feeding, effect on flavor of milk, U.S.D.A., 377.  
   v. sunflower silage for steers, Can., 468.  
   variety tests, Can., 432.  
 Turpentine—  
   beetle, red, notes, 755.  
   value against chicken nematode, Minn., 152.  
 Tussock moth, white-marked, control, 844.  
 Twins and heredity, 731.  
*Tychius picirostris*, notes, N.Y.Cornell, 57.

*Tylenchus*—  
   *devastatrix*, relation to bulbs, 452.  
   *dipsaci*, description, U.S.D.A., 145.  
   *dipsaci*, occurrence, 754.  
   *dipsaci* on alfalfa, 747.  
   *dipsaci*, studies, 447.  
*Tylocladia fragariae*. (See Strawberry crown-borer.)  
*Typhlocyba comes*. (See Grape leafhopper.)  
 Typhoid—  
   fever, avian, 82, 586.  
   fly. (See House fly.)  
   immunization, oral route for, 478.  
 Udo root rot and wilt, 655.  
 Ultrafiltration apparatus, 612.  
 Ultraviolet light—  
   action on bone marrow, 564.  
   effect on calcium in blood, 260.  
   treatment for rickets, effect, 669.  
   use against plant diseases, 345.  
 Ultraviolet rays—  
   absorption by atmospheric ozone, 208, 315.  
   effect on rats deprived of vitamin A, 61.  
 Undernutrition in steers, 670.  
   (See also Diet deficient, Malnutrition, and Nutrition.)  
 United States Department of Agriculture—  
   Office of Experiment Stations. (See Office of Experiment Stations.)  
   States Relations Service. (See States Relations Service.)  
 United States Warehouse Act, U.S.D.A., 293.  
 Urea—  
   as protein substitute for lactating animals, 677.  
   determination, 204.  
   synthetic, fertilizing value, 424.  
 Urease, use in urea determination, 204.  
*Uredo nicotianae*, notes, 248.  
 Urine proteins, differentiation, 204.  
   (See also Manure, liquid.)  
*Urocystis cepulae*, control, 349.  
*Uromyces*—  
   *caryophyllinus*, notes, 547.  
   *medicaginis*, notes, 447.  
   *pisi*, biology, 446.  
*Urophlyctis alfalfae*, notes, 447.  
*Ustilago*—  
   *pantoi milacel*, treatment, 349.  
   spp., cycle of development, 347.  
   spp., notes, 548.  
   *tritici*, occurrence on wheat, 144.  
 Utah—  
   College, notes, 699.  
   Station, notes, 699.  
 Uterus—  
   extirpation, effect on corpus luteum, 826.  
   reversion of, 381.  
 Vaccination by ingestion, 478.



## Vaccines—

- bacterial, influence of age and temperature, 282.
- preparing, new method, 879.
- size of prophylactic dose, relation to protection, 282.

Vacuoles, origin in aleurone during germination, 222.

Vaginitis, granular, in cattle, 882.

## Vanilla—

- beans, solvents for extracting, 501.
- botany, culture, and manufacture, 39.
- extracts, analyses, Conn.State, 160.

Variation, inheritance in *Chlorophytum*, 23.

Vascular anatomy of bamboo, new feature in, 728.

## Vegetable—

- gardening, treatise, 740.  
(See also Gardening.)
- oils. (See Oils.)
- proteins. (See Proteins.)

## Vegetables—

- acclimatization, Alaska, 539.
- culture experiments, V.I., 540.
- culture in Porto Rico, 36.
- culture, textbook, 395.
- diseases and insects, U.S.D.A., 834.
- distribution and prices in Great Britain, 293.
- from Volga region, composition, 169.
- insects affecting, 51.
- irrigation studies, Can., 340.
- manure requirements, R.I., 35.
- scoring exhibits in, 195.
- variety tests, Can., 36, 440, 643.

## Velvet bean—

- feed, digestibility, Mass., 168.
- meal, vitamin B in, 367.

## Velvet beans—

- breeding experiments, S.C., 637.
- feeding value, Miss., 68; S.C., 73.

Ventilation systems in farm buildings, 689.

*Venturia pomi*, notes, 353.

*Vermicularia circinans*, notes, 143.

*Verticillium*—

- alboatrum*, notes, 248, 449, 547, 655.
- sp. on beach, 751.

Vetch, marbled variety, production, 228.

Vetches, analyses, Oreg., 7.

## Veterinary—

- medicine, manual, 180.
- medicine, progress in, 76.
- ophthalmology, textbook, 379.
- studies for agricultural students, treatise, 76.  
(See also Animal diseases.)

*Viburnum americanum* as garden fruit, 836.

## Vicia—

- cracca* as silage crop, Alaska, 532.
- hirsuta*, distinguishing characteristics, 439.

Vinegar, home production, Iowa, 113.

Vinuish, effect of nutrition, 266.

Virgin Islands Station, report, 598.

Virginia Station, notes, 398.

Virus diseases of plants, 244.

Viruses, filterable, 78.

## Viscosity—

- as measure of hydration capacity of flour, 503.
- of protoplasm, 525.

## Vitamin—

A and antirachitic vitamin, differentiation, 858.

A, chemistry of, 801; Minn., 163.

A content of millets, 364.

A deficiency and ophthalmia, 60.

A deficiency, cause of nasal sinus infection, 263.

A deficiency, changes in paraocular glands, 464.

A deficiency, effect on reproduction, 60, 163.

A deficiency in poultry, 871.

A deficiency, ocular lesions produced by, 463.

A deficiency, pathologic effects, 263.

A in artichokes, changes in, 462.

A in citrus fruits, 59.

A in diet, effect of quantity on calcification of bones, 264.

A in linseed oil, 163.

A in milk, 567.

A in skim milk, 59.

A in walnuts, 462.

A, mode of action, 858.

A potency in fish liver oils, 664, 665, 858.

A, storage, 60, 363.

A, storage and synthesis, 666.

antirachitic and vitamin A, differentiation, 858.

antirachitic, deficiency, pathologic effects, 263.

B, action of dry and moist heat, 858.

B and antineuritic vitamin, identity, 770.

B, chemical nature, Minn., 163.

B, color test for, 506.

B deficiency, relation to bacterial infection, 770.

B deficiency, rôle of suprarenals in, 859.

B, effect on egg production, Pa., 473.

B from bacteria, 664.

B in artichokes, changes in, 462.

B in velvet bean meal, 367.

B in yeast, 768.

B, parenteral administration, 465.

B, relative values in yeast and wheat embryo, Minn., 163.

B starvation, basal metabolism in, 63.

B studies with pigeons, 264.

B, usefulness in insulin cure, 864.

C deficient diet, scurvy production by, 166.

C in milk, effect of spray process of drying, 564.

C in oysters, 465.

C, occurrence and properties, 859.

D in sugar cane, 564.

## Vitamin—Continued.

- D, studies, 363.
- deficiency, effect on adrenals, 668.
- deficiency in the diet, 565.
- (See also Avitaminosis.)
- requirements, effect of exercise, 464.
- requirements of animals, 266.
- requirements of chicks, 373.
- requirements of cows, Minn., 175.
- research, present status, 856.

## Vitamins—

- and bacterial growth, 769.
- and manganese, association, 463.
- extraction from yeast, 506.
- function in metabolism, 565.
- in fish meal, takage, and blood meal, 573.
- in milk, 175, 857.
- in milk, effect of autoclaving, 62.
- in mushrooms, 857.
- in palm kernel meal, 64.
- in plants, development, 769.
- in raisins, Pa., 463.
- inorganic substances as substitutes for, 564.
- mode of action, 665.
- physiology, 465.
- relation to poultry diseases, N.J., 383.
- stability, 664.
- studies, Minn., 163.

Vocational education. (See Agricultural education, vocational.)

Volutin in fungi, 428.

## Walls—

- heat transmission through, measuring, 589.
- hollow tile, compressive tests, 386.
- retaining, reinforced concrete, design, 286.

## Walnut—

- blight, studies, 753.
- pests, control, new developments, 52.

## Walnuts—

- breeding, Can., 340.
- culture experiments, Minn., 138.
- culture in Europe and Asia, 543.
- grafting, 343.
- nutritive value of proteins, 462.
- vitamin A in, 462.

Warble fly in Switzerland, 560.

*Wardomyces anomala* n.g. and n.sp., description, 763.

Washington Station, notes, 196.

Wasps that hunt cicadas, habits, 359.

## Water—

- examination, *Bacillus coli* method, limitations, 288.
- examination, standard methods, 804.
- glass, bibliography, 615.
- ground, in United States, 685.
- hemlock poisonous to livestock, 78.
- irrigation. (See Irrigation water.)
- movements in soils, 84.
- powers, undeveloped, of Tennessee, 483.

## Water—Continued.

- purification by chlorin gas, effect of temperature, 590.
- rain. (See Rain.)
- requirements of crops, 733, 828.
- resources of California, 84.
- running, in farm houses, 486.
- supply of Gulf of Mexico basins, 789.
- supply of Hudson Bay and upper Mississippi basins, 789.
- supply of lower Mississippi basin, 186.
- supply of Pacific slope basins, 789.
- supply of St. Lawrence basin, 789.
- supply of South Atlantic slope, 789.
- vapor condensation, relation to dust, 414.
- well, for irrigation, 885.

## Watermelon—

- anthracnose, control, S.C., 648.
- leaves, temperature, 425.

Watermelons, variety tests, U.S.D.A., 137.

Waterproofing materials, colorless, exposure tests, 887.

Water-soluble B. (See Vitamin B.)

Water-soluble C. (See Vitamin C.)

## Weather—

- and forest fires, 807.
- conditions during winter of 1922-23 and solar radiation, 314.
- conditions-unfavorable to agriculture, 615.
- control, 616.
- correlation with potato late blight, N.J., 47.
- forecasting in British Isles, 314.
- forecasting, local, 12.
- forecasting, present status, 208.
- in British Isles, 1923, 716.
- in 1924, 616.
- in Texas, effect of Gulf water-surface temperatures, U.S.D.A., 115.
- influences in British Isles, 416.
- of 1923, U.S.D.A., 808.
- of Palestine, effect of wind direction, 616.
- proverbs and paradoxes, treatise, 415.
- relation to citrus diseases, 752.
- reports for Alaska, Alaska, 510.
- seasonal variations, correlation, 510.
- service of United States, origin and growth, 808.
- weekly notes, U.S.D.A., 92, 294, 491.
- world, treatise, 12.
- (See also Meteorological observations and Meteorology.)

Webworm, fall, parasites of, 844.

Weed seeds, scented, in wheat, 438.

## Weeds—

- and seeds in Indiana, 740.
- control in pastures, 338.
- definition, 439.
- in Ceylon, 238.
- in Indiana, 641.
- on arable land, effect of fertilizers, 740.
- studies, Minn., 137.



Weevils, instincts and habits, 359.

Wells—

boring, 587.

pollution from *Bacillus coli*, 83.

West Virginia—

Station, notes, 900.

Station, report, 195.

University, notes, 700, 900.

Western Washington Station, bimonthly bulletin, 195, 598.

Wheat—

adaptation to nutrient deficient media, 326.

as affected by chromium, 820.

as affected by lead, 820.

as affected by sulphur, Oreg., 724.

black point, 144, 649.

black stem rust, inoculation experiments, 839.

blackhull, description, 538.

bran, proteins of, 711.

breeding experiments, 28; Minn., 132.

breeding in Italy, 333.

bunt. (*See* Wheat smut, stinking.)

commercial outlook, 594.

contamination from scented weed seeds, 438.

cost of production, Can., 591; Ind., 389.

cost of production in France, 191.

cross, inheritance of glume length, 27.

crosses, inheritance of black stem rust resistance, 634, 635.

culture experiments, 28.

cutting stage, 237.

disease resistant varieties, development, Minn., 143.

effect of different pH values, 232.

experiments, continuous, yields, 637.

fertilizer experiments, 28; Minn., 120.

flour. (*See* Flour.)

foot rot in Kansas, 649.

foot rot, notes, 244.

Fusarium, notes, 648.

geniculate spikes in, 728.

germination, effect of bunt treatment, 144.

germination, fertilizer injury to, N.J., 216.

gliadin, hydrolysis products, 8.

grains, double embryos in, 833.

grass seed, testing, 740.

Helminthosporium disease, 649.

hybrids, internode length and number of spikelets, 633.

hybrids, sterility in, Me., 26, 27.

inheritance of kernel and spike characters, 732.

insulin in, 767.

intracellular bodies in, 839.

jointworms, notes, 51.

kernel plumpness and protein content, 438.

kernel, ungerminated, nonprotein nitrogen in, 712.

Wheat—Continued.

Kota, description, U.S.D.A., 33.

Kubanka durum, improvement, U.S.D.A. 337.

large root systems, effect, 525.

leaf rust, notes, 546.

loose smut, notes, 144.

midge, notes, 51.

mill feeds, standards for in Wisconsin, 573.

milling, 806.

milling and baking experiments, U.S.D.A., 738.

New Zealand grown, milling tests, 438.

of southeastern Russia, milling and baking tests, 337.

*Ophiobolus cariceti* on, 145.

Polish, characteristics, U.S.D.A., 33.

possibilities in Kansas, 533.

poulard, characteristics, U.S.D.A., 33.

production in Nebraska, effect of climate, 715.

production in northern Alaska, 538.

rate of manuring tests, Minn., 120, 121.

rosette disease, varietal resistance, 650.

rotation experiments, N.Y. State, 422.

rust, summer attacks, 738.

scab, relation to H-ion concentration, 44.

screenings, for wintering lambs, 574.

seed, electrochemical treatment, U.S. D.A., 738.

seed, treated, germination, 740.

seeding experiments, Minn., 132.

seedling blight, cause, 648.

seedlings, infection with *Helminthosporium*, factors affecting, 649.

Sevier, description, 640.

situation, U.S.D.A., 389.

smut, control, 649.

smut, stinking, control, 347, 348; Calif., 43.

smut, stinking, prevention, 245.

smut, stinking, studies, 245.

smutted, spike structure, 237.

spelt factor, relation to rachis internode characters, 228.

spike, two sides, productivity, 237.

spring—

certification in Germany, 439.

culture experiments, Alaska, 532; Can., 231.

rust resistant, producing, 635.

varieties, characteristics, 237.

variety tests, Can., 533; Minn.,

133; Mont., 133, 134; West.

Wash., 134.

stem rust, effect of fertilizers on, 549.

stem rust, studies, Minn., 144.

straw, fertilizing value, Minn., 121.

straw, production of gas from, U.S. D.A., 387.

take-all, cause, 549.

take-all disease, notes, 746.

threshing in the Punjab, 88.

## Wheat—Continued.

varieties for seed in Poland, 439.  
varieties, hard, in Morocco, 438.  
varieties in New South Wales, 438.  
varieties, new, in Italy, 437.  
variety tests, 28; Pa., 432; S.C., 637;  
U.S.D.A., 132.

(See also Wheat, spring, and  
Wheat, winter.)

water requirements, 734, 828.

water requirements, effect of rust in-  
fection, 649.

Week, National, at Paris, 539.

## winter—

certification in Germany, 439.  
cold resistance, biochemistry,  
Minn., 137.  
culture, N.Dak., 33.  
culture experiments, Alaska, 532;  
Mont., 133.  
natural crossing in, 634.  
resistance, 231.  
varieties, characteristics, 237.  
variety tests, Minn., 133; Mont.,  
133, 134; West.Wash., 134.  
yield and climate at Maryland Station,  
641.  
yield in England during seven cen-  
turies, 641.

## Whey—

propionic acid and ketones in, 205.  
utilization, 280.

## White—

ants. (See Termites.)  
flies of Jamaica, 556.  
grubs, Mich., 496.

## White pine blister rust—

effect on Ribes, 656.  
in Europe, U.S.D.A., 843.  
infection, 753.  
spore germination, 656.

## White pine—

chemical injuries, 753.  
distribution and habits, 344.  
germination, 444.  
insects affecting, 153.  
losses from weevil damage, 57.  
needle blight, notes, 753.  
seedlings, fertilizer experiments, 443.

White scours and calf pneumonia, Minn.,  
181.

Wind direction, effect on weather of Pal-  
estine, 616.

Wireworm, false, biology, 849.

## Wisconsin—

Station, notes, 398, 790.  
University, notes, 398, 790.

*Wojnowicia graminis* on wheat, 145.

## Woods—

American, analysis of heartwood and  
sapwood, 712.

cellulose, acetolysis reaction, 509.

cellulose, hydrolysis products, 9.

cellulose, nature of, 206.

chemistry, 712.

destroying fungi, effect of heat, 754.

distillation products, methoxyl in, 206.

distillation, treatise, 587.

fibers, identification in paper pulp,  
509.

for butter boxes, Calif., 782.

French colonial, properties, 647.

kiln drying, boxing, and gluing, demon-  
stration courses in, U.S.D.A., 41.

lice, notes, 255.

penetration of molds in, 656.

preservation with low temperature  
creosotes, 485.

pulp and pulpwood in North America,  
treatise, 545.

pulp, determining bleach requirement,  
715.

pulp production, statistics, U.S.D.A.,  
41.

pulp, storage in water, 754.

*Xanthomyia*, new genus, erection, 457.

*Xenopsylla cheopsis*, notes, 55.

## Xerophthalmia—

development, effect of light and dark-  
ness, 61.

in Denmark, 772.

*Xiphophorus helleri*, sex differentiation in,  
331.

X-rays. (See Roentgen rays.)

*Xylaria* sp. on apple seedlings, 750.

*Xyleborus fornicatus*, summary, 454.

## Yams—

culture experiments, 828.

variety tests, 28, 828.

Yautias, spacing experiments, P.R., 533.

## Yeast—

dietary properties, 768.

growth on synthetic media, 769, 853.

growth stimulant and vitamin B, 363.

nutritive value, 561.

parasitic on Lima beans, 650.

studies, 362.

vitamin extraction from, 506.

Yeasts, effect on keeping quality of but-  
ter, 476.

Yellow fever mosquito, notes, U.S.D.A., 53.

Yellowstone National Park, trees and  
flowers of, 645.

Zein, hydrolysis products, analyses, 611.

Zinc determination in gelatin, 712.

Zoological meteorological studies, 255.

Zoology, handbook, 252.

## ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM  
THE SUPERINTENDENT OF DOCUMENTS  
GOVERNMENT PRINTING OFFICE  
WASHINGTON, D. C.

AT

10 CENTS PER COPY  
SUBSCRIPTION PRICE, 75 CENTS PER YEAR







